

**231 Goldhurst Terrace,  
NW6 3EP**

**Basement Impact Assessment  
Audit**

For

London Borough of Camden

Project Number: 12066-33  
Revision: D2

October 2015

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### Document Details

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## 1.0 NON-TECHNICAL SUMMARY

- 1.1. CampbellReith was instructed by London Borough of Camden, (LBC) to carry out an audit on the Basement Impact Assessment submitted as part of the Planning Submission documentation for 231 Goldhurst Terrace, London NW6 3EP (planning reference 2015/2384/P). The basement is considered to fall within Category B as defined by the Terms of Reference.
- 1.2. The Audit reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development in accordance with LBC's policies and technical procedures.
- 1.3. CampbellReith was able to access LBC's Planning Portal and gain access to the latest revision of submitted documentation and reviewed it against an agreed audit check list.
- 1.4. The BIA and BSMS have been carried out by engineering consultants using individuals who possess suitable qualifications, other than the authors of the BSMS not identifying suitable expertise in engineering geology.
- 1.5. The BIA has confirmed that the proposed basement will be founded within the London Clay. It should be confirmed that the bearing strata has an adequate bearing capacity.
- 1.6. It is unlikely that the groundwater table will be encountered during basement foundation excavation. However, proposal for the removal of water from the excavation during construction are provided.
- 1.7. It is recommended that further investigation of the neighbouring foundations is carried out as noted in the BIA.
- 1.8. Outline proposals are provided for a movement monitoring strategy during excavation and construction have been provided with a proposal to record conditions before and after construction. The outline proposals will have to be developed and agreed with the Party Wall Surveyor.
- 1.9. Further investigation should be undertaken to identify the cause (location of damaged drainage runs) of the foul water encountered in the bore holes.
- 1.10. An outline Construction Programme was provided, although it indicates the underpinning will be completed in 2 days. As this is a concern to the neighbour, a realistic programme should be provided.
- 1.11. It is that there will be no additional surface water run-off to the public sewer, in which case the development will not impact on the wider hydrology and hydrogeology of the area.

- 1.12. The GMA is to be resubmitted in order to close out the query discussed in Section 4.12 of this report.
- 1.13. It is accepted that the surrounding slopes to the development site are stable.
- 1.14. Queries and matters requiring further information or clarification are summarised in Appendix 2.

## 2.0 INTRODUCTION

- 2.1. CampbellReith was instructed by London Borough of Camden (LBC) on 17/07/15 to carry out a Category B Audit on the Basement Impact Assessment (BIA) submitted as part of the Planning Submission documentation for 231 Goldhurst Terrace, NW6 3EP, 2015/2384/P.
- 2.2. The Audit was carried out in accordance with the Terms of Reference set by LBC. It reviewed the Basement Impact Assessment for potential impact on land stability and local ground and surface water conditions arising from basement development.
- 2.3. A BIA is required for all planning applications with basements in Camden in general accordance with policies and technical procedures contained within
- Guidance for Subterranean Development (GSD). Issue 01. November 2010. Ove Arup & Partners.
  - Camden Planning Guidance (CPG) 4: Basements and Lightwells.
  - Camden Development Policy (DP) 27: Basements and Lightwells.
  - Camden Development Policy (DP) 23: Water
- 2.4. The BIA should demonstrate that schemes:
- a) maintain the structural stability of the building and neighbouring properties;
  - b) avoid adversely affecting drainage and run off or causing other damage to the water environment; and,
  - c) avoid cumulative impacts upon structural stability or the water environment in the local area.
- and evaluate the impacts of the proposed basement considering the issues of hydrology, hydrogeology and land stability via the process described by the GSD and to make recommendations for the detailed design.
- 2.5. LBC's Audit Instruction described the planning proposal as *"Excavation at basement level for ancillary floorspace with front and rear lightwells, erection of a single storey rear extension with bay window and roof lantern, installation of external staircases between the ground floor and basement, new lift platform to the front, disabled ramp to the rear elevation and new decking area to the rear."*

- 2.6. CampbellReith accessed LBC's Planning Portal on 18<sup>th</sup> August 2015 and gained access to the following relevant documents for audit purposes:
- 231 Goldhurst Terrace Basement Structural Method Statement Rev 2 – Croft Structural Engineers, November 2014
  - Basement Impact Assessment – Ashton Bennett Consultancy, June 2015
  - Block Plan
  - Location Plan18112014
  - Existing Drawings
  - Proposed Drawings.
- 2.7. Further to the issue of CampbellReith's draft BIA audit report, a number of the queries raised were addressed in an email dated 7 September 2015 and sent by RPR Planning to CampbellReith and LBC. A copy is presented in Appendix 3. Subsequently, Revision 4 of the Basement Structural Method Statement was issued to CampbellReith by email on 16 September 2015. The BSMS and covering email are presented in Appendix 3.

### 3.0 BASEMENT IMPACT ASSESSMENT AUDIT CHECK LIST

Item	Yes/No/NA	Comment
Are BIA Author(s) credentials satisfactory?	YES	See page 1 of BIA
Is data required by Cl.233 of the GSD presented?	YES	Indicative programme provided by email on 7.9.15 however, suggests 2 days for underpinning.
Does the description of the proposed development include all aspects of temporary and permanent works which might impact upon geology, hydrogeology and hydrology?	YES	
Are suitable plan/maps included?	YES	
Do the plans/maps show the whole of the relevant area of study and do they show it in sufficient detail?	YES	Various maps and plans throughout BIA and appendices
Land Stability Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	YES	See BIA table 4, Section 10.1
Hydrogeology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	YES	See BIA table 4, Section 10.1
Hydrology Screening: Have appropriate data sources been consulted? Is justification provided for 'No' answers?	YES	See BIA table 4, Section 10.1
Is a conceptual model presented?	YES	Not referred to as a Conceptual Model, however, detailed Site Description (section 2.1), Ground Conditions (Section 12.2) and Site Settings (Section 13.2) are provided.
Land Stability Scoping Provided?	YES	See BIA table 5, Section 10.2



Item	Yes/No/NA	Comment
Is scoping consistent with screening outcome?		
Hydrogeology Scoping Provided? Is scoping consistent with screening outcome?	YES	See BIA table 5, Section 10.2
Hydrology Scoping Provided? Is scoping consistent with screening outcome?	YES	See BIA table 5, Section 10.2
Is factual ground investigation data provided?	YES	See BIA Section 12 and Appendix C
Is monitoring data presented?	YES	See BIA Section 12.5
Is the ground investigation informed by a desk study?	YES	See BIA Section 13.1
Has a site walkover been undertaken?	YES	Stated in BIA Section 13.1
Is the presence/absence of adjacent or nearby basements confirmed?	NO	Not confirmed. Refer to BIA Section 13.8. Not considered significant in light of absence of significant subterranean flows.
Is a geotechnical interpretation presented?	YES	See BIA Section 12
Does the geotechnical interpretation include information on retaining wall design?	YES	See BIA Section 13.6
Are reports on other investigations required by screening and scoping presented?	YES	See BIA Section 11 and 12, and Appendix C and D for FRA and GI.
Are baseline conditions described, based on the GSD?	YES	See BIA Table 4
Do the base line conditions consider adjacent or nearby basements?	YES	See BIA Table 4, although further investigation required.
Is an Impact Assessment provided?	YES	See BIA Section 13

Item	Yes/No/NA	Comment
Are estimates of ground movement and structural impact presented?	YES	See Section 1 of the 'Basement Structural Method Statement', however methodology not clear.
Is the Impact Assessment appropriate to the matters identified by screen and scoping?	YES	See BIA Section 13
Has the need for mitigation been considered and are appropriate mitigation methods incorporated in the scheme?	YES	See BIA Table 5
Has the need for monitoring during construction been considered?	YES	See Section 1 of the 'Basement Structural Method Statement'
Have the residual (after mitigation) impacts been clearly identified?	YES	See BIA Section 10.2
Has the scheme demonstrated that the structural stability of the building and neighbouring properties and infrastructure will be maintained?	NO	See Section 1 of the 'Basement Structural Method Statement'
Has the scheme avoided adversely affecting drainage and run-off or causing other damage to the water environment?	YES	Attenuation and grey water recycling proposed to minimise additional run-off to public sewer. This will require agreement with Thames Water.
Has the scheme avoided cumulative impacts upon structural stability or the water environment in the local area?	NO	No clear assessment of ground movements and impacts on adjacent structures.
Does report state that damage to surrounding buildings will be no worse than Burland Category 2?	NA	Methodology is not clear and needs re-submitting before the Burland Category can be confirmed.
Are non-technical summaries provided?	YES	Overall summary provided on page 2 of the BIA

## 4.0 DISCUSSION

- 4.1. The Basement Impact Assessment (BIA) has been carried out by engineering geologists, Ashton Bennett, and the individuals concerned in its production have suitable qualifications.
- 4.2. The Basement Structural Method Statement (BSMS) has been carried out by engineering consultants, Croft Structural Engineers. The reviewer is a chartered structural engineer. No evidence is provided that the structural assessment has been made in conjunction with a Chartered Geologist (as required in CPG4), however, the report lists that they have extensive experience in completing 120 basements in the last 4 years.
- 4.3. The LBC Instruction to proceed with the audit identified that there are no listed buildings present and the BIA agrees with this statement.
- 4.4. The proposed works include lowering an existing undercroft to form a basement under the entire footprint of the building. This basement will also extend to the rear of the property. A new lightwell will form a separate entrance at the front. It is proposed to excavate approximately 1.5m to form a 2.5m deep basement space.
- 4.5. The BIA has identified the basement (and associated underpins) will extend into the London Clay Formation. The Ground Investigation confirms that the depth of Made Ground is relatively shallow at 0.20-0.80m, beneath which is London Clay of increasing strength.
- 4.6. The BSMS discusses the underpinning construction sequence. This sequence is described in detail with mention of maximum dimensions for underpins that can be carried out in each dig as well as timescales between pours. Sequence of underpinning drawings are also provided. Structural analysis has been carried out to confirm reinforcement of pins and propping positions. This analysis makes suitable assumptions on loading including hydrostatic pressures from the water table rising. There is no mention of the need to provide heave protection below the basement slab in the BSMS Rev 4. However, this is suggested as a requirement in the main BIA in Section 10.2.
- 4.7. It is noted that the Ground Investigation suggests maximum allowable bearing pressures should be assumed to be 70-112kN/m<sup>2</sup>. However, the BSMS uses a value of 120kN/m<sup>2</sup>. Ashton Bennet confirmed by email on 7 September 2015 that this was acceptable.
- 4.8. The design of the basement has been checked for overall buoyancy of the structure during peak groundwater levels. This concludes that the structure is not buoyant.
- 4.9. Groundwater was encountered in the boreholes, although, this was later confirmed through testing, to be foul water. It is suggested, in the BIA, that this is from damaged or leaking foul

drainage runs in the local vicinity of the site. These are to be repaired as part of the construction works. We accept this is a sensible assumption and solution.

- 4.10. Although groundwater is not expected to be encountered during excavation, provision for sump pumping has been suggested and the BIA states that any softened materials should be removed. The design of the underpin retaining walls has allowed for worst case water levels at ground level. The basement is to be tanked to account for any water that penetrates through the underpin retaining wall.
- 4.11. An assessment of expected movement to adjacent properties has been based calculated and has classified anticipated damage as Category of Damage 0, although the damage is described as negligible to slight which equates to Burland Category 0 to 2. It is stated that minor repairs to hairline cracks to neighbouring properties will be carried out where required. However, it is not clear which building the assessment relates to and more detail is required to confirm that the assessment is adequate and has been correctly applied. No assessment has been made of the settlement of the underpins.
- 4.12. There were several assumptions and statements in the original ground movement assessment (GMA) that needed justification. A number were clarified in an email of 16 September 2015 and the revised BSMS. However, whilst it is accepted that the ground movements are reasonable, the building damage assessment has not been carried out as required by CIRIA C580.
- 4.13. It is noted that the current adjacent foundations are unknown, and it is recommended that further investigation is undertaken to confirm foundations depths in this area. However, the assumption of the absence of a basement is conservative with respect to the building damage assessment.
- 4.14. No proposals were provided for a movement monitoring strategy during excavation and construction in the original BIA. Revision 4 of the BSMS contains an indicative monitoring regime. This will have to be developed further to include trigger levels and mitigation measures and agreed as part of the Party Wall awards.
- 4.15. It is accepted that there are no slope stability concerns regarding the proposed development.

## 5.0 CONCLUSIONS

- 5.1. The BIA and BSMS have been carried out by engineering consultants using individuals who possess suitable qualifications, other than the authors of the BSMS not identifying suitable expertise in engineering geology.
- 5.2. The BIA has confirmed that the proposed basement will be founded within the London Clay. It should be confirmed that the bearing strata has an adequate bearing capacity.
- 5.3. It is unlikely that the groundwater table will be encountered during basement foundation excavation. However, proposal for the removal of water from the excavation during construction are provided.
- 5.4. It is recommended that further investigation of the neighbouring foundations is carried out as noted in the BIA.
- 5.5. Outline proposals are provided for a movement monitoring strategy during excavation and construction have been provided with a proposal to record conditions before and after construction. Monitoring is recommended. The outline proposals will have to be developed and agreed with the Party Wall Surveyor.
- 5.6. Further investigation should be undertaken to identify the cause (location of damaged drainage runs) of the foul water encountered in the bore holes.
- 5.7. An outline Construction Programme was provided, although it indicates the underpinning will be completed in 2 days. As this is a concern to the neighbour, a realistic programme should be provided.
- 5.8. It is that there will be no additional surface water run-off to the public sewer, in which case the development will not impact on the wider hydrology and hydrogeology of the area.
- 5.9. The GMA is to be resubmitted in order to close out the query as discussed in Section 4.12 of this report.
- 5.10. It is accepted that the surrounding slopes to the development site are stable.

## **Appendix 1: Resident's Consultation Comments**

Residents' Consultation Comments

Surname	Address	Date	Issue raised	Response
Nasser	233 Goldhurst Terrace, NW6 3EP	07/06/15	<p>The actual plans and outline are fine with me provided we negotiate a party wall agreement with the Zur-Spiros. In addition I would like to see more details of the construction plan, how long it will take and environmental impact during construction. We have a new baby on the way and we would want to make sure that safeguards are put in place to reduce noise, dust etc etc. Knowing the Zur-Spiros personally and therefore knowing they are responsible and good neighbours we believe they will keep inconvenience to a minimum but would still like to see the timeline etc etc.</p>	<p>A construction Sequence is provided in the 'Basement Structural Method Statement', however, there does not appear to be an indication of time scales or Construction Programme dates.</p> <p>We note that the method of construction is underpinning which, although generally has a longer construction phase, will be less noise intrusive than other methods such as piling.</p> <p>The request to provide a Construction Programme has been added to the Audit Query Tracker in Appendix 2.</p>

## **Appendix 2: Audit Query Tracker**



Audit Query Tracker

Query No	Subject	Query	Status/Response	Date closed out
1	Stability	The ground investigation has suggested maximum bearing capacities at the level of the basement of 70-112kN/m <sup>2</sup> . The Basement Structural Method Statement has used 120kN/m <sup>2</sup> . Please confirm why a higher value has been used.	Clarification and confirmation provided by email (see Appendix 3).	07/09/15
2	Stability	Construction Programme required.	Indicative programme provided by email although it indicated 2 days to complete underpinning. A realistic programme should be provided.	
3	Stability	Depth and type of adjacent foundations to be confirmed.	Open – It is accepted that the approach is conservative and appropriate.	
4	Stability	The Ground Investigation has identified the need for heave protection below the basement slab. This is not covered in the design of the basement.	Open.	
5	Stability	Movement Assessment to be reviewed and re-issued for comment. See Section 4.13 of this report.	Open.	
6	Surface Flow and Flooding	Agreement required from Thames Water in order to discharge additional run off to the public sewer.	Confirmed by Ashton Bennett on 7 September that no additional flows to network.	

## **Appendix 3: Supplementary Supporting Documents**



**Re: Fwd: 231 Goldhurst Terrace NW 6 3EP** 📎

**Sam Knight** to: Ray Reilly  
Cc: Zenab Haji-Ismail, Liz Brown, camdenaudit  
This message is digitally signed.

07/09/2015 16:26

Hi Ray,

The query regarding point 5 below is discussed in the Audit Report. I've copied the relevant section below. Could Croft Structural Engineers provide a response to this:

*There are several assumptions and statements in the ground movement assessment (GMA) that need justification. These are:*

- *The figure at the start of the GMA appears to show the property being underpinned as opposed to the neighbouring property being assessed for movement. It is not clear which building /part of building is being assessed.*
- *The estimate of movement for installation seems adequate, however, the assessment for movements due to excavation assume a high stiffness support, confirmation is required that this is appropriate for a cantilevered wall.*
- *The plotted ground movement does not appear to agree with the figures predicted.*
- *It is not clear where vertical ground movements have been considered.*
- *The BSMS states damage will be 'Negligible to Slight Category 0'. This is confusing - Negligible is Category 0 (hairline crack) and Slight is Category 2 (cracks up to 5mm).*

Kind regards,

**Sam Knight**  
Senior Engineer

**CampbellReith**  
consulting engineers

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Ray Reilly	Zenab, Sam, Please see attached response and...	07/09/2015 13:53:42
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From: Ray Reilly <info@rprplanning.co.uk>  
To: Zenab Haji-Ismail <Zenab.Haji-Ismail@camden.gov.uk>, "SamKnight@campbellreith.com" <SamKnight@campbellreith.com>  
Date: 07/09/2015 13:53  
Subject: Fwd: 231 Goldhurst Terrace NW6 3EP

Zenab, Sam,

Please see attached response and attachment from the Basement consultant for this project.  
A second response will follow from Structural Engineers.

Regards,

Ray Reilly  
Director  
RPR Planning  
07896617854.

Begin forwarded message:

**From:** "Frances Bennett" <[fabennett@ashton-bennett.co.uk](mailto:fabennett@ashton-bennett.co.uk)>  
**To:** "[msarchitects@btconnect.com](mailto:msarchitects@btconnect.com)" <[msarchitects@btconnect.com](mailto:msarchitects@btconnect.com)>  
**Cc:** "Ray Reilly" <[info@rprplanning.co.uk](mailto:info@rprplanning.co.uk)>, "Susan Zur-Szpiro" <[susanzs231@gmail.com](mailto:susanzs231@gmail.com)>  
**Subject:** 231 Goldhurst Terrace NW6 3EP

Sarah,

The information still required by audit is:

- 1 Programme of Works  
This is really for the Contractor to produce as part of his MS, however Table attached.
- 2 Foundation depth of adjacent houses

We cannot dig up ground to expose neighbours foundations, we have assumed in BIA a conservative approach of foundations at ground level, although we anticipate 233 will have similar part basement as 231.

- 3 Further clarification is required on bearing capacity of 70-112kN/m<sup>2</sup> (ABC) or 120kN/m<sup>2</sup> (BSMS)

The figures given by ABC 70-112kN/m<sup>2</sup> are based on SPT results using empirical calculations to determine bearing capacity taking into account a Factor of Safety of 3. BSMS uses a well-publicised figure of 120kN/m<sup>2</sup> for bearing capacity in London Clay. I expect the clay in situ has been softened by the water leaks.

- 4 Further justification required on ground movement figures (BSMS)

The ground movement results are detailed in the BSMS Report and are to CIRIA 580.

What further justification is required?

- 5 Movement Monitoring strategy required (BSMS)

Croft Engineers have resubmitted report with a monitoring strategy.

6 Cause of foul water required

CCTV has been undertaken and drains will be replaced as part of the construction work as stated in the BIA.

7 Design of basement should take heave into account (BSMS)

Recommendations are made in the Report for compressible material or a void beneath the floor slab. The structural MS is only a brief summary of proposals and the mitigating measures for heave will have to be incorporated in final design.

8 Agreement required from Thames Water regarding run off to public sewer

I do not think this is a requirement for a BIA. Provided the storm water is collected by rainwater harvesting as suggested in the BIA Report there will be no extra water to public sewer. There will not be any extra people in the house following basement construction. Therefore an agreement with TW is not required.

Hope this helps finalise the audit, let me know if there is anything else they require and I will sort it out,

Kind Regards,

Frances

Frances A Bennett

BSc(Hons), CGeol, FGS, FIMMM, C.WEM, MCIWEM, CEnv, AIEMA, MIEnvSci  
Director

[cid:8E87E8CB-BADF-4FF3-A1E8-4F47D89F682B]

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"Programme of Works.docx.doc" deleted by Sam Knight/CRH] [attachment  
"ATT00002.htm" deleted by Sam Knight/CRH]

Job Number: 141002  
27<sup>th</sup> October 2014



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# Basement Structural Method Statement – Structural Calculations & drawings

231 Goldhurst Terrace  
NW6 3EP London

Frances Bennett  
Bridge Mills,  
Huddersfield Rd, Holmfirth,  
West Yorkshire HD9 3TW

Structural Design Reviewed by  
Chris Tomlin  
MEng CEng MIStructE

Revision	Date	Comment
-	27/10/14	First Issue
1	05/11/14	Minor alterations to structural drawings
2	17/11/14	Designer's reference added
3	02/09/15	Monitoring added
4	16/09/15	Minor alterations to Audit comments



## Table of Contents

### 1. Design Information - Structural

#### Monitoring

Monitoring 1

Monitoring 2

Monitoring 3

Risk Assessment

Monitoring 4

#### Appendix A

Structural Scheme Drawings

#### Appendix B

Structural Basement Calculations

RC retaining wall 1 design

RETAINING WALL ANALYSIS (BS 8002:1994)

RETAINING WALL DESIGN (BS 8002:1994)

RC retaining wall 2 design

RETAINING WALL ANALYSIS (BS 8002:1994)

RETAINING WALL DESIGN (BS 8002:1994)

Horizontal Movement Assessment

#### Appendix C

Method Statement

1. Basement Formation Suggested Method Statement.
2. Enabling works
3. Basement Sequencing
4. Underpinning – Cantilevered Wall Creation
5. Approval

Standard Lap Trench Sheeting

KD4 sheets



## 1. Design Information - Structural

### Structural Summary

231 Goldhurst Terrace is a single occupancy Victorian Property Located in the borough of Camden. The structure of the property is load bearing masonry external walls, internal load bearing masonry walls on the ground floor and masonry & stud walls on the first floor. Timber floors on each floor and timber roof.



*Figure 1: 231 Goldhurst Terrace: Front*

### Proposed works

The proposed works require the insertion of a new basement under the property.

Croft Structural Engineers Ltd Structural Engineers has extensive knowledge of inserting new basements. Over the last 4 years we have completed over 150 basements in and around the local area. The method developed is:

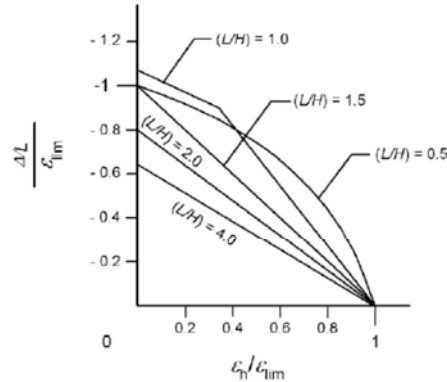
1. Excavate front to allow for conveyor to be inserted.
2. Form lightwell with cantilevered retaining walls
3. Slowly work from the front to the rear inserting 1200 long

	<p>cantilevered retaining walls sequentially.</p> <p>4. Cast ground slab</p> <p>5. Waterproof internal space with a drained cavity system.</p> <p><b>Structural Defects Noted</b></p> <p>No defects were noted during the Chartered Engineers first visit.</p>								
Progressive Collapse	<p>Family/domestic use</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr style="background-color: #4F81BD; color: white;"> <th></th> <th style="text-align: center;">UDL kN/m<sup>2</sup></th> <th style="text-align: center;">Concentrated Loads kN</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">Domestic Single Dwellings</td> <td style="text-align: center; padding: 2px;">1.5</td> <td style="text-align: center; padding: 2px;">1.4</td> </tr> </tbody> </table> <p>4</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 70%;">Is Live Load Reduction included in design</td> <td style="text-align: right; vertical-align: top;">No</td> </tr> </table> <p>Reinforced concrete cantilevered retaining walls</p> <p>The designs for the retaining walls have been calculated using Finite element software TEDDS. The software is specifically designed for retaining walls and ensures the design is kept to a limit to prevent damage to the adjacent property.</p> <p>Results can be found in appendix B.</p> <p>The overall stability of the walls are design using <math>K_a</math> &amp; <math>K_p</math> values, while the design of the wall uses <math>K_o</math> values. This approach minimise the level of movement from the concrete affecting the adjacent properties.</p> <p>The Investigations have highlight that water is a present. The walls are designed to cope with the hydrostatic pressure. The water table was low. The design of the walls however considers the long term items. It is possible that a water main may break causing local high water table. To account for this the wall is designed for water 1m from the top of the wall.</p> <p>The Design also considers floatation as a risk. The design of has considered the weight of the building and the uplift forces from the water. The weight of the building is greater than the uplift resulting in a stable structure.</p> <p>The building does not undermine the highway, but car parking is present</p>		UDL kN/m <sup>2</sup>	Concentrated Loads kN	Domestic Single Dwellings	1.5	1.4	Is Live Load Reduction included in design	No
	UDL kN/m <sup>2</sup>	Concentrated Loads kN							
Domestic Single Dwellings	1.5	1.4							
Is Live Load Reduction included in design	No								

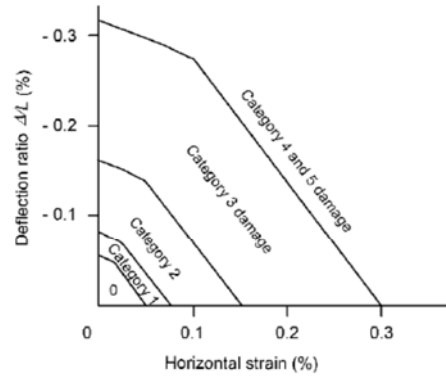
	<p>to the front of the property. It is possible for heavier goods vehicles to reverse on to the property to allow for this risk loadings are to be taken from the Highways loading code.</p> <p>5kN/m<sup>2</sup> to front light well</p> <p>Garden Surcharge 2.5kN/m<sup>2</sup></p> <p>Surcharge for adjacent property 1.5kN/m<sup>2</sup> + 4kN/m<sup>2</sup> for concrete ground bearing slab</p>				
Is the Building Multi Occupancy?	No				
Lateral Stability	<p>EN 1991-1-7:1996 Table A1</p> <table border="1" data-bbox="472 840 1409 963"> <tr> <td colspan="2" style="background-color: #4F81BD; color: white;"> </td> </tr> <tr> <td style="background-color: #4F81BD; color: white;">Class 1</td> <td style="background-color: #4F81BD; color: white;">Single occupancy houses not exceeding 4 storeys</td> </tr> </table> <p>Class1 – Design to satisfy EN 1990 to EN 1999 stability requirements</p>			Class 1	Single occupancy houses not exceeding 4 storeys
Class 1	Single occupancy houses not exceeding 4 storeys				
Exposure and wind loading conditions	<p>Basic wind speed <math>V_b = 21</math> m/s to EC1-2                  Site level +75.000 m above sea level.                  Topography not considered significant.</p>				
Stability Design	The cantilevered walls are suitable to carry the lateral loading applied from above				
Lateral Actions	<p>The soil loads apply a lateral load on the retaining walls.</p> <p>Hydrostatic pressure will be applied to the wall</p> <p>Imposed loading will surcharge the wall.</p>				

Adjacent Properties	<p><i>Any ground works pose an elevated risk to adjacent properties. The proposed works undermines the adjacent property along the party wall line:</i></p> <p>The party wall is to be underpinned. Underpinning the party wall will remove the risk of the movement to the adjacent property.</p> <p>The works must be carried out in accordance with the party wall act and condition surveys will be necessary at the beginning and end of the works.</p> <p>The method statement provided at the end of this report has been formulated with our experience of over 120 basements completed without error.</p> <p>The design of the retaining walls is completed to <math>K_0</math> lateral design stress values. This increases the design stresses on the concrete retaining walls and limits the overall deflection of the retaining wall.</p> <p>It is not expected that any cracking will occurring during the works. However our experience informs us that there is a risk of movement to the neighbours.</p> <p>To reduce the risk the development:</p> <ul style="list-style-type: none"><li>• Employ a reputable firm for extensive knowledge of basement works.</li><li>• Employ suitably qualified consultants. Croft Structural engineer has completed over 120 basements in the last 4 years.</li><li>• Design the underpins to the stable without the need for elaborate temporary propping or needing the floor slab to be present.</li><li>• Provide method statements for the contractors to follow</li><li>• Investigate the ground, now completed.</li><li>• Record and monitor the external properties. This is completed by a condition survey on under the Party Wall Act before and after the works are completed. See end of method statement.</li><li>• Allow for unforeseen ground conditions: Loose ground is always a concern. The method statement and drawings show the use of precast lintels to areas of soft ground; this follows the guidance by the underpinning association.</li></ul>
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With the above the maximum level of cracking anticipated is Hairline cracking which can be repaired with decorative cracking and can be repaired with decorative repairs. Under the party wall Act damage is allowed (although unwanted) to occur to a neighbouring property as long as repairs are suitably undertaken to rectify this. To mitigate this risk The Party Wall Act is to be followed and a Party Wall Surveyor will be appointed.



(b) Influence of horizontal strain on  $\Delta L / \epsilon_{lim}$  (after Burland, 2001)



(c) Relationship between damage category and deflection ratio and horizontal tensile strain for hogging for  $(L/H) = 1.0$  (after Burland, 2001)

Extract from The Institution of Structural Engineers “Subsidence of Low-Rise Buildings”

Table 6.2 Classification of visible damage to walls with particular reference to type of repair, and rectification consideration

Category of Damage	Approximate crack width	Limiting Tensile strain	Definitions of cracks and repair types/considerations
0	Up to 0.1	0.0-0.05	<b>HAIRLINE</b> – Internally cracks can be filled or covered by wall covering, and redecorated. Externally, cracks rarely visible and remedial works rarely justified.
1	0.2 to 2	0.05-0.075	<b>FINE</b> – Internally cracks can be filled or covered by wall covering, and redecorated. Externally, cracks may be visible, sometimes repairs required for weather tightness or aesthetics. NOTE: Plaster cracks may, in time, become visible again if not covered by a wall covering.
2	2 to 5	0.075-0.015	<b>MODERATE</b> – Internal cracks are likely to need raking out and repairing to a recognised specification. May need to be chopped back, and repaired with expanded metal/plaster, then redecorated. The crack will inevitably become visible again in time if these measures are not carried out. External cracks will require raking out and repointing, cracked bricks may require replacement.

	3	5 to 15	0.15- 0.3	<u>SERIOUS</u> – Internal cracks repaired as for MODERATE, plus perhaps reconstruction if seriously cracked. Rebonding will be required. External cracks may require reconstruction perhaps of panels of brickwork. Alternatively, specialist resin bonding techniques may need to be employed and/or joint reinforcement.
	4	15 to 25	>0.3	<u>SEVERE</u> Major reconstruction works to both internal and external wall skins are likely to be required. Realignment of windows and doors may be necessary.
	5	Greater than 25		<u>VERY SEVERE</u> –Major reconstruction works, plus possibly structural lifting or sectional demolition and rebuild may need to be considered. Replacement of windows and doors, plus other structural elements, possibly necessary. NOTE – Building & CDM Regulations will probably apply to this category of work, see sections 10.4, 10.6 and Appendix F.

## Monitoring

**Monitoring** - In order to safeguard the existing structures during underpinning and new basement construction movement monitoring is to be undertaken.

### Monitoring Level proposed

### Type of Works.

#### Monitoring 1

Visual inspection and production of condition survey by Party wall surveyors at the beginning of the works and also at the end of the works.

Loft conversions, cross wall removals, insertion of padstones  
Survey of LUL and Network Rail tunnels.

Mass concrete, reinforced and Piled foundations to new build properties

#### Monitoring 2

Visual inspection and production of condition survey by Party wall surveyors at the beginning of the works and also at the end of the works.

Removal of lateral stability and insertion of new stability frames  
Removal of main masonry load bearing walls.

Visual inspection of existing party wall during the works.

Underpinning works less than 1.2m deep

Inspection of the footing to ensure that the footings are stable and adequate.

#### Monitoring 3

Visual inspection and production of condition survey by Party wall surveyors at the beginning of the works and also at the end of the works.

Lowering of existing basement and cellars more than 2.5m

Underpinning works less than 3.0m deep in clays

Visual inspection of existing party wall during the works.

Basements up to 2.5m deep in clays

Inspection of the footing to ensure that the footings are stable and adequate.

Vertical monitoring movement by standard optical equipment

Risk  
Assessment

#### Monitoring 4

Visual inspection and production of condition survey by Party wall surveyors at the beginning of the works and also at the end of the works.

Visual inspection of existing party wall during the works.

Inspection of the footing to ensure that the footings are stable and adequate.

Vertical monitoring movement by standard optical equipment

Lateral movement between walls by laser measurements

New basements greater than 2.5m and shallower than 4m Deep in gravels

Basements up to 4.5m deep in clays

Underpinning works to grade I listed building



## Appendix A

### Structural Scheme Drawings

This information is provided for Planning use only and is not to be used for Building control submissions

## Appendix B

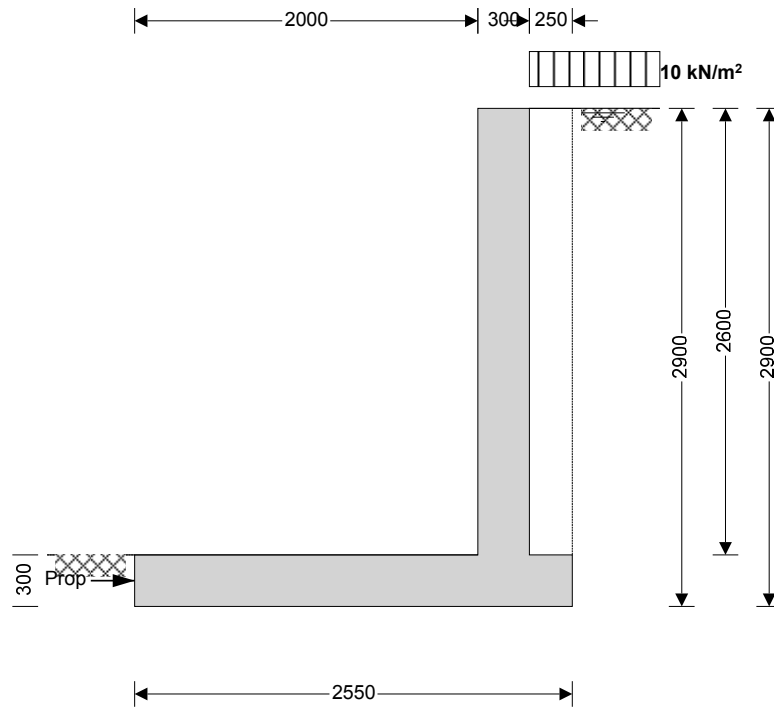
### Structural Basement Calculations

This information is provided for Planning use only and is not to be used for Building control submissions

## RC retaining wall 1 design

### RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



#### Wall details

Retaining wall type	<b>Cantilever</b>	Wall stem thickness	$t_{wall} = 300$ mm
Height of wall stem	$h_{stem} = 2600$ mm	Length of heel	$l_{heel} = 250$ mm
Length of toe	$l_{toe} = 2000$ mm	Base thickness	$t_{base} = 300$ mm
Overall length of base	$l_{base} = 2550$ mm	Thickness of downstand	$t_{ds} = 300$ mm
Height of retaining wall	$h_{wall} = 2900$ mm	Unplanned excavation depth	$d_{exc} = 0$ mm
Depth of downstand	$d_{ds} = 0$ mm	Density of water	$\gamma_{water} = 9.81$ kN/m <sup>3</sup>
Position of downstand	$l_{ds} = 1650$ mm	Density of base construction	$\gamma_{base} = 23.6$ kN/m <sup>3</sup>
Depth of cover in front of wall	$d_{cover} = 0$ mm	Effective height at back of wall	$h_{eff} = 2900$ mm
Height of ground water	$h_{water} = 2900$ mm	Saturated density	$\gamma_s = 21.0$ kN/m <sup>3</sup>
Density of wall construction	$\gamma_{wall} = 23.6$ kN/m <sup>3</sup>	Angle of wall friction	$\delta = 0.0$ deg
Angle of soil surface	$\beta = 0.0$ deg	Design base friction	$\delta_b = 18.6$ deg
Mobilisation factor	$M = 1.5$	Allowable bearing	$P_{bearing} = 120$ kN/m <sup>2</sup>
Moist density	$\gamma_m = 18.0$ kN/m <sup>3</sup>	Passive pressure	$K_p = 4.187$
Design shear strength	$\phi' = 24.2$ deg	Active pressure	$K_a = 0.419$
Design shear strength	$\phi'_b = 24.2$ deg	At-rest pressure	$K_0 = 0.590$
Moist density	$\gamma_{mb} = 18.0$ kN/m <sup>3</sup>		

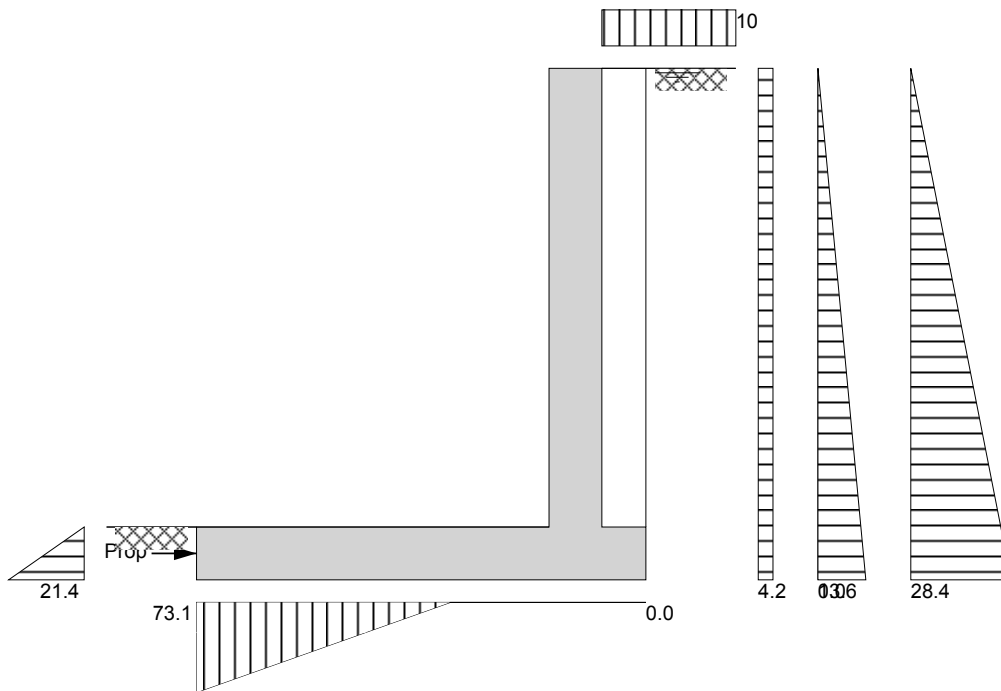
#### Using Coulomb theory

Active pressure	$K_a = 0.419$	Passive pressure	$K_p = 4.187$
At-rest pressure	$K_0 = 0.590$		

#### Loading details

Surcharge load	Surcharge = <b>10.0</b> kN/m <sup>2</sup>	Vertical live load	$W_{live} = 0.0$ kN/m
Vertical dead load	$W_{dead} = 0.0$ kN/m		

Horizontal dead load	$F_{dead} = 0.0 \text{ kN/m}$	Horizontal live load	$F_{live} = 0.0 \text{ kN/m}$
Position of vertical load	$l_{load} = 0 \text{ mm}$	Height of horizontal load	$h_{load} = 0 \text{ mm}$



Loads shown in kN/m, pressures shown in kN/m<sup>2</sup>

Calculate propping force

Propping force  $F_{prop} = 53.0 \text{ kN/m}$

Check bearing pressure

Total vertical reaction  $R = 52.6 \text{ kN/m}$

Distance to reaction  $X_{bar} = 480 \text{ mm}$

Eccentricity of reaction  $e = 795 \text{ mm}$

**Reaction acts outside middle third of base**

Bearing pressure at toe  $p_{toe} = 73.1 \text{ kN/m}^2$

Bearing pressure at heel  $p_{heel} = 0.0 \text{ kN/m}^2$

**PASS - Maximum bearing pressure is less than allowable bearing pressure**

## RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor  $\gamma_{f,d} = 1.4$

Live load factor  $\gamma_{f,l} = 1.6$

Earth pressure factor  $\gamma_{f,e} = 1.4$

Calculate propping force

Propping force  $F_{prop} = 53.0 \text{ kN/m}$

Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

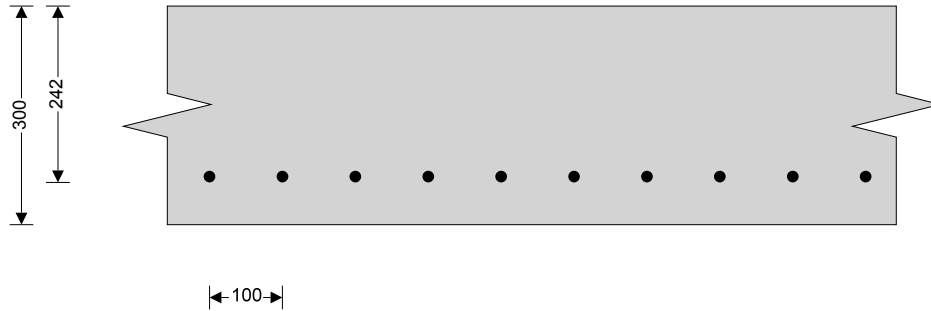
Strength of concrete  $f_{cu} = 35 \text{ N/mm}^2$

Strength of reinforcement  $f_y = 500 \text{ N/mm}^2$

Base details

Minimum reinforcement  $k = 0.13 \%$

Cover in toe  $C_{toe} = 50 \text{ mm}$



Design of retaining wall toe

Shear at heel	$V_{toe} = 54.3 \text{ kN/m}$	Moment at heel	$M_{toe} = 126.0 \text{ kNm/m}$
		<b>Compression reinforcement is not required</b>	

Check toe in bending

Reinforcement provided	<b>16 mm dia.bars @ 100 mm centres</b>		
Area required mm <sup>2</sup> /m	$A_{s\_toe\_req} = 1291.7 \text{ mm}^2/\text{m}$	Area provided	$A_{s\_toe\_prov} = 2011$

**PASS - Reinforcement provided at the retaining wall toe is adequate**

Check shear resistance at toe

Design shear stress	$V_{toe} = 0.225 \text{ N/mm}^2$	Allowable shear stress	$V_{adm} = 4.733 \text{ N/mm}^2$
		<b>PASS - Design shear stress is less than maximum shear stress</b>	

Concrete shear stress	$V_{c\_toe} = 0.754 \text{ N/mm}^2$
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**$V_{toe} < V_{c\_toe}$  - No shear reinforcement required**

Design of reinforced concrete retaining wall heel (BS 8002:1994)

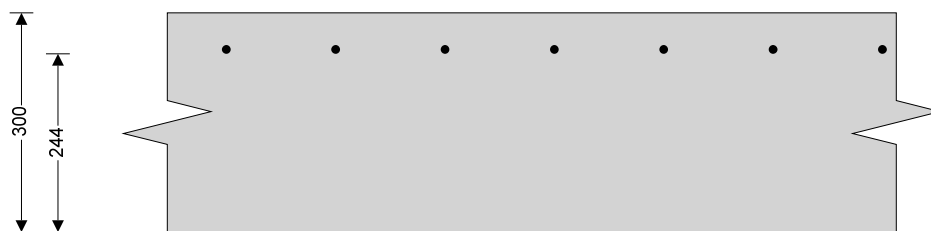
Material properties

Strength of concrete	$f_{cu} = 35 \text{ N/mm}^2$	Strength of reinforcement	$f_y = 500 \text{ N/mm}^2$
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Base details

Minimum reinforcement	$k = 0.13 \%$	Cover in heel	$C_{heel} = 50 \text{ mm}$
-----------------------	---------------	---------------	----------------------------

|← 150 →|



Design of retaining wall heel

Shear at heel	$V_{heel} = 25.6 \text{ kN/m}$	Moment at heel	$M_{heel} = 7.1 \text{ kNm/m}$
		<b>Compression reinforcement is not required</b>	

Check heel in bending

Reinforcement provided	<b>12 mm dia.bars @ 150 mm centres</b>		
Area required mm <sup>2</sup> /m	$A_{s\_heel\_req} = 390.0 \text{ mm}^2/\text{m}$	Area provided	$A_{s\_heel\_prov} = 754$

**PASS - Reinforcement provided at the retaining wall heel is adequate**

Check shear resistance at heel

Design shear stress	$V_{heel} = 0.105 \text{ N/mm}^2$	Allowable shear stress	$V_{adm} = 4.733 \text{ N/mm}^2$
		<b>PASS - Design shear stress is less than maximum shear stress</b>	

Concrete shear stress	$V_{c\_heel} = 0.541 \text{ N/mm}^2$
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**$V_{heel} < V_{c\_heel}$  - No shear reinforcement required**

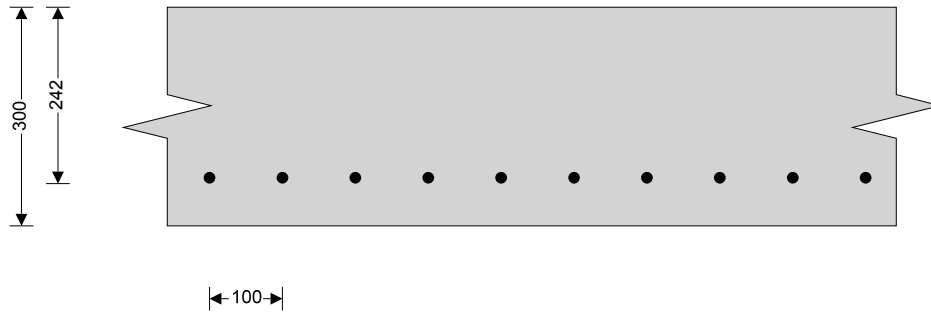
Design of reinforced concrete retaining wall stem (BS 8002:1994)

Material properties

Strength of concrete  $f_{cu} = 35 \text{ N/mm}^2$       Strength of reinforcement  $f_y = 500 \text{ N/mm}^2$

Wall details

Minimum reinforcement  $k = 0.13 \%$   
Cover in stem  $c_{stem} = 50 \text{ mm}$       Cover in wall  $c_{wall} = 50 \text{ mm}$



Design of retaining wall stem

Shear at base of stem  $V_{stem} = 6.3 \text{ kN/m}$       Moment at base of stem  $M_{stem} = 102.9 \text{ kNm/m}$

**Compression reinforcement is not required**

Check wall stem in bending

Reinforcement provided **16 mm dia.bars @ 100 mm centres**  
Area required  $A_{s\_stem\_req} = 1039.1 \text{ mm}^2/\text{m}$       Area provided  $A_{s\_stem\_prov} = 2011 \text{ mm}^2/\text{m}$

**PASS - Reinforcement provided at the retaining wall stem is adequate**

Check shear resistance at wall stem

Design shear stress  $V_{stem} = 0.026 \text{ N/mm}^2$       Allowable shear stress  $V_{adm} = 4.733 \text{ N/mm}^2$

**PASS - Design shear stress is less than maximum shear stress**

Concrete shear stress  $V_{c\_stem} = 0.754 \text{ N/mm}^2$

**$V_{stem} < V_{c\_stem}$  - No shear reinforcement required**

## RC retaining wall 2 design

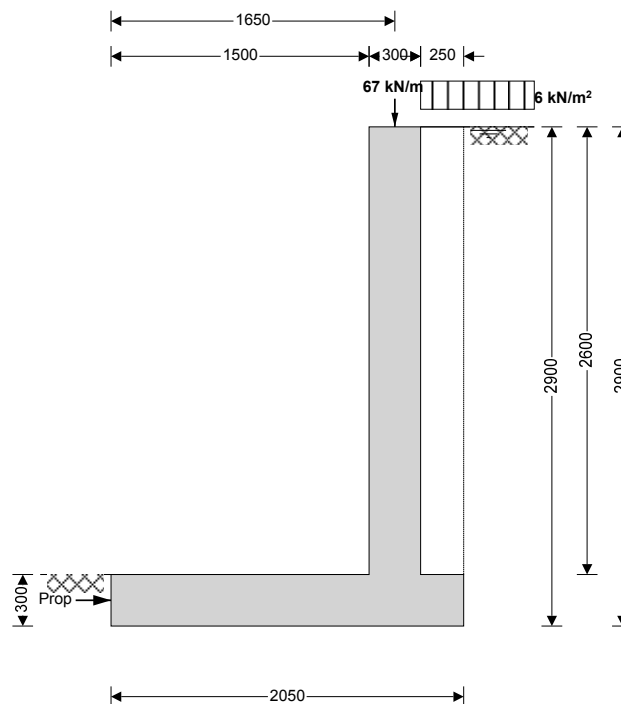
Floor & roof loads doubled to allow for load from neighbouring property.

Loading:

Masonry wall	$DL_{\text{masonry}} = 5\text{kN/m}^2 \times 6.5\text{m} = \mathbf{32.500\text{kN/m}}$
Timber joists (2 <sup>nd</sup> , 1 <sup>st</sup> , ground floor) DL	$DL_{\text{floor}} = 3 \times 0.7\text{kN/m}^2 \times 4.1\text{m} / 2 \times 2 = \mathbf{8.610\text{kN/m}}$
Roof Load DL	$DL_{\text{roof}} = 1.1\text{kN/m}^2 \times 4.1\text{m} / 2 \times 2 = \mathbf{4.510\text{kN/m}}$
Total Dead Load	$DL = DL_{\text{masonry}} + DL_{\text{floor}} + DL_{\text{roof}} = \mathbf{45.620\text{kN/m}}$
Timber joists (2 <sup>nd</sup> , 1 <sup>st</sup> , ground floor) LL	$LL_{\text{floor}} = 3 \times 1.5\text{kN/m}^2 \times 4.1\text{m} / 2 \times 2 = \mathbf{18.450\text{kN/m}}$
Roof Load DL	$LL_{\text{roof}} = 0.6\text{kN/m}^2 \times 4.1\text{m} / 2 \times 2 = \mathbf{2.460\text{kN/m}}$
Total Dead Load	$LL = LL_{\text{floor}} + LL_{\text{roof}} = \mathbf{20.910\text{kN/m}}$

## RETAINING WALL ANALYSIS (BS 8002:1994)

TEDDS calculation version 1.2.01.06



### Wall details

Retaining wall type	<b>Cantilever</b>		
Height of wall stem	$h_{\text{stem}} = \mathbf{2600\text{ mm}}$	Wall stem thickness	$t_{\text{wall}} = \mathbf{300\text{ mm}}$
Length of toe	$l_{\text{toe}} = \mathbf{1500\text{ mm}}$	Length of heel	$l_{\text{heel}} = \mathbf{250\text{ mm}}$
Overall length of base	$l_{\text{base}} = \mathbf{2050\text{ mm}}$	Base thickness	$t_{\text{base}} = \mathbf{300\text{ mm}}$
Height of retaining wall	$h_{\text{wall}} = \mathbf{2900\text{ mm}}$		
Depth of downstand	$d_{\text{ds}} = \mathbf{0\text{ mm}}$	Thickness of downstand	$t_{\text{ds}} = \mathbf{300\text{ mm}}$
Position of downstand	$l_{\text{ds}} = \mathbf{1650\text{ mm}}$		
Depth of cover in front of wall	$d_{\text{cover}} = \mathbf{0\text{ mm}}$	Unplanned excavation depth	$d_{\text{exc}} = \mathbf{0\text{ mm}}$
Height of ground water	$h_{\text{water}} = \mathbf{2900\text{ mm}}$	Density of water	$\gamma_{\text{water}} = \mathbf{9.81\text{ kN/m}^3}$
Density of wall construction	$\gamma_{\text{wall}} = \mathbf{23.6\text{ kN/m}^3}$	Density of base construction	$\gamma_{\text{base}} = \mathbf{23.6\text{ kN/m}^3}$
Angle of soil surface	$\beta = \mathbf{0.0\text{ deg}}$	Effective height at back of wall	$h_{\text{eff}} = \mathbf{2900\text{ mm}}$

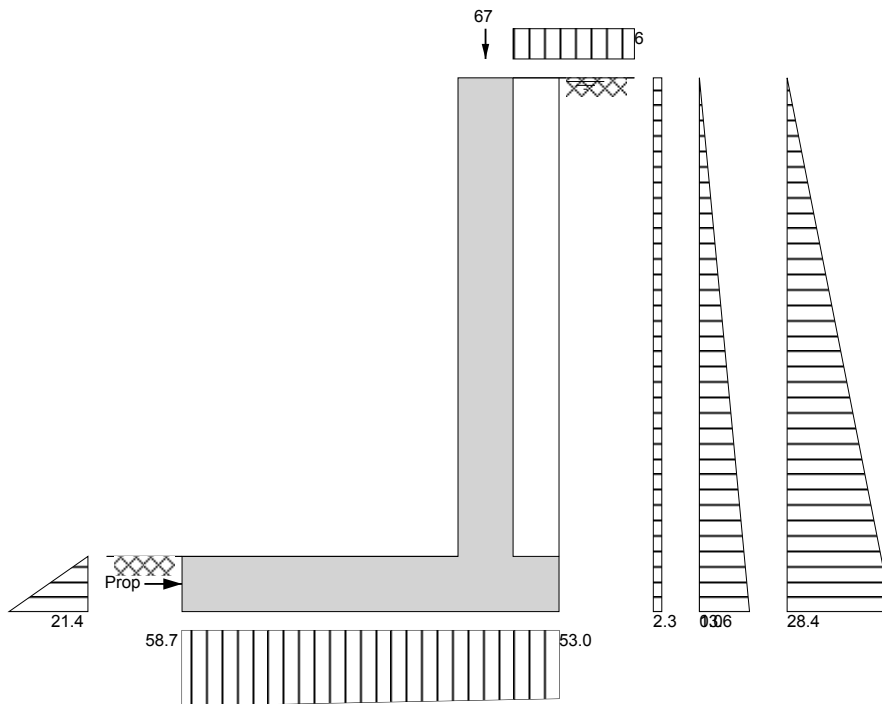
Mobilisation factor	$M = 1.5$	Saturated density	$\gamma_s = 21.0 \text{ kN/m}^3$
Moist density	$\gamma_m = 18.0 \text{ kN/m}^3$	Angle of wall friction	$\delta = 0.0 \text{ deg}$
Design shear strength	$\phi^i = 24.2 \text{ deg}$	Design base friction	$\delta_b = 18.6 \text{ deg}$
Design shear strength	$\phi^b = 24.2 \text{ deg}$	Allowable bearing	$P_{\text{bearing}} = 120 \text{ kN/m}^2$
Moist density	$\gamma_{mb} = 18.0 \text{ kN/m}^3$		

Using Coulomb theory

Active pressure	$K_a = 0.419$	Passive pressure	$K_p = 4.187$
At-rest pressure	$K_0 = 0.590$		

Loading details

Surcharge load	Surcharge = $5.5 \text{ kN/m}^2$		
Vertical dead load	$W_{\text{dead}} = 45.6 \text{ kN/m}$	Vertical live load	$W_{\text{live}} = 20.9 \text{ kN/m}$
Horizontal dead load	$F_{\text{dead}} = 0.0 \text{ kN/m}$	Horizontal live load	$F_{\text{live}} = 0.0 \text{ kN/m}$
Position of vertical load	$l_{\text{load}} = 1650 \text{ mm}$	Height of horizontal load	$h_{\text{load}} = 0 \text{ mm}$



Loads shown in kN/m, pressures shown in kN/m<sup>2</sup>

Calculate propping force

Propping force  $F_{\text{prop}} = 33.4 \text{ kN/m}$

Check bearing pressure

Total vertical reaction  $R = 114.5 \text{ kN/m}$  Distance to reaction  $X_{\text{bar}} = 1008 \text{ mm}$   
Eccentricity of reaction  $e = 17 \text{ mm}$

Bearing pressure at toe  $p_{\text{toe}} = 58.7 \text{ kN/m}^2$  Bearing pressure at heel  $p_{\text{heel}} = 53.0 \text{ kN/m}^2$

**PASS - Maximum bearing pressure is less than allowable bearing pressure**

RETAINING WALL DESIGN (BS 8002:1994)

TEDDS calculation version 1.2.01.06

Ultimate limit state load factors

Dead load factor  $\gamma_{f_d} = 1.4$  Live load factor  $\gamma_{f_l} = 1.6$   
Earth pressure factor  $\gamma_{f_e} = 1.4$

(Library item: ULS load factors summary)



Calculate propping force

Propping force  $F_{prop} = 33.4$  kN/m

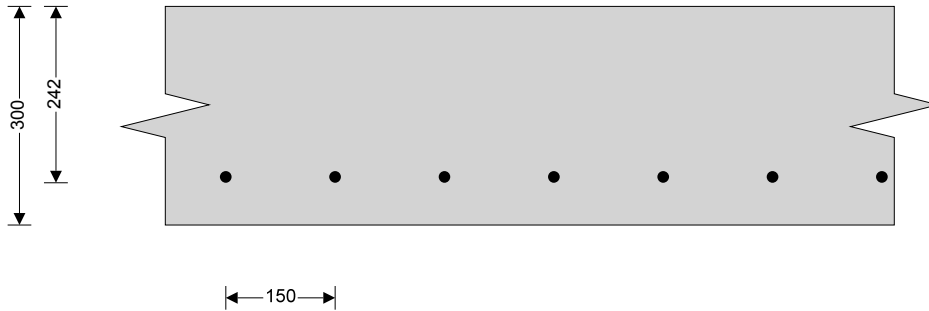
Design of reinforced concrete retaining wall toe (BS 8002:1994)

Material properties

Strength of concrete  $f_{cu} = 35$  N/mm<sup>2</sup>      Strength of reinforcement  $f_y = 500$  N/mm<sup>2</sup>

Base details

Minimum reinforcement  $k = 0.13$  %      Cover in toe  $C_{toe} = 50$  mm



Design of retaining wall toe

Shear at heel  $V_{toe} = 116.7$  kN/m      Moment at heel  $M_{toe} = 113.1$  kNm/m  
**Compression reinforcement is not required**

Check toe in bending

Reinforcement provided **16 mm dia.bars @ 150 mm centres**  
Area required  $A_{s\_toe\_req} = 1150.0$  mm<sup>2</sup>/m      Area provided  $A_{s\_toe\_prov} = 1340$  mm<sup>2</sup>/m

**PASS - Reinforcement provided at the retaining wall toe is adequate**

Check shear resistance at toe

Design shear stress  $V_{toe} = 0.482$  N/mm<sup>2</sup>      Allowable shear stress  $V_{adm} = 4.733$  N/mm<sup>2</sup>  
**PASS - Design shear stress is less than maximum shear stress**

Concrete shear stress  $V_{c\_toe} = 0.658$  N/mm<sup>2</sup>  
 **$V_{toe} < V_{c\_toe}$  - No shear reinforcement required**

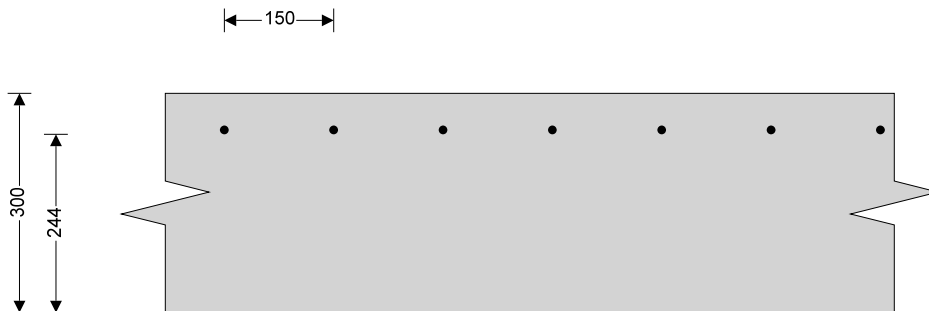
Design of reinforced concrete retaining wall heel (BS 8002:1994)

Material properties

Strength of concrete  $f_{cu} = 35$  N/mm<sup>2</sup>      Strength of reinforcement  $f_y = 500$  N/mm<sup>2</sup>

Base details

Minimum reinforcement  $k = 0.13$  %      Cover in heel  $C_{heel} = 50$  mm



Design of retaining wall heel

Shear at heel  $V_{heel} = 9.7$  kN/m      Moment at heel  $M_{heel} = 2.1$  kNm/m  
**Compression reinforcement is not required**

Check heel in bending

Reinforcement provided **12 mm dia.bars @ 150 mm centres**  
 Area required  $A_{s\_heel\_req} = 390.0 \text{ mm}^2/\text{m}$  Area provided  $A_{s\_heel\_prov} = 754 \text{ mm}^2/\text{m}$

**PASS - Reinforcement provided at the retaining wall heel is adequate**

Check shear resistance at heel

Design shear stress  $v_{heel} = 0.040 \text{ N/mm}^2$  Allowable shear stress  $v_{adm} = 4.733 \text{ N/mm}^2$

**PASS - Design shear stress is less than maximum shear stress**

Concrete shear stress  $V_{c\_heel} = 0.541 \text{ N/mm}^2$

**$v_{heel} < V_{c\_heel}$  - No shear reinforcement required**

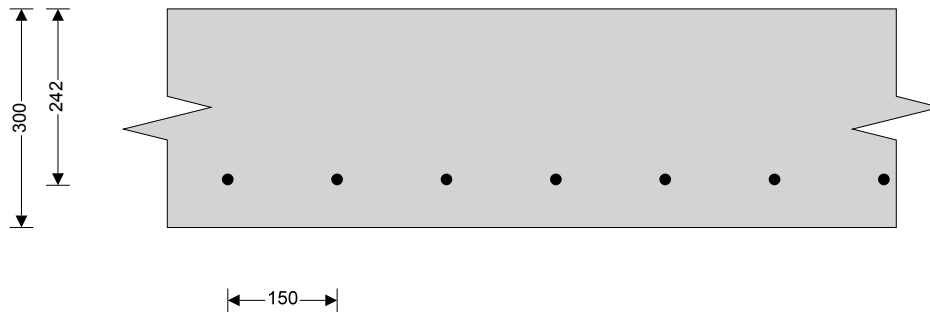
Design of reinforced concrete retaining wall stem (BS 8002:1994)

Material properties

Strength of concrete  $f_{cu} = 35 \text{ N/mm}^2$  Strength of reinforcement  $f_y = 500 \text{ N/mm}^2$

Wall details

Minimum reinforcement  $k = 0.13 \%$   
 Cover in stem  $C_{stem} = 50 \text{ mm}$  Cover in wall  $C_{wall} = 50 \text{ mm}$



Design of retaining wall stem

Shear at base of stem  $V_{stem} = 27.4 \text{ kN/m}$  Moment at base of stem  $M_{stem} = 86.9 \text{ kNm/m}$

**Compression reinforcement is not required**

Check wall stem in bending

Reinforcement provided **16 mm dia.bars @ 150 mm centres**  
 Area required  $A_{s\_stem\_req} = 868.8 \text{ mm}^2/\text{m}$  Area provided  $A_{s\_stem\_prov} = 1340 \text{ mm}^2/\text{m}$

**PASS - Reinforcement provided at the retaining wall stem is adequate**

Check shear resistance at wall stem

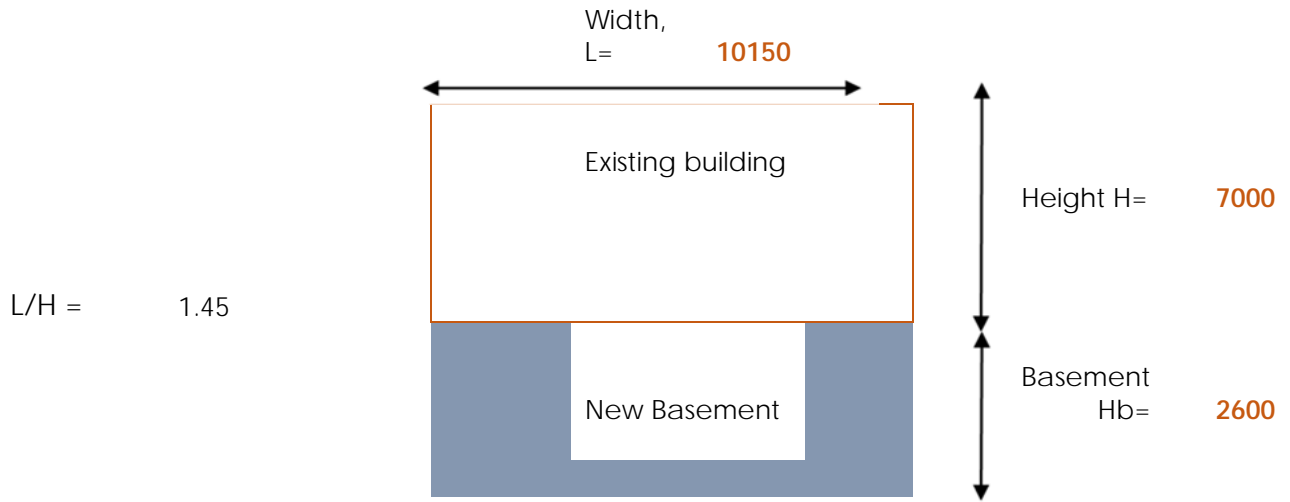
Design shear stress  $v_{stem} = 0.113 \text{ N/mm}^2$  Allowable shear stress  $v_{adm} = 4.733 \text{ N/mm}^2$

**PASS - Design shear stress is less than maximum shear stress**

Concrete shear stress  $V_{c\_stem} = 0.658 \text{ N/mm}^2$

**$v_{stem} < V_{c\_stem}$  - No shear reinforcement required**

## Movement Assessment



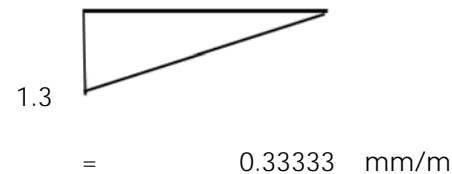
### Movement Assessment CIRIA C580: Embedded Retaining walls - Guide to Economic Design

#### Potential Movement Due to wall installation

$$\begin{aligned} \text{Horizontal surface movement} &= 0.05\% \\ \Delta H &= 0.05\% \times 2600 = 1.3 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{Vertical Surface Movement} &= 0.05\% \\ \Delta V &= 0.05\% \times 2600 = 1.3 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{Distance behind wall to negligible movement} \\ l_h = 2600 \times 1.5 = 3900 \text{ mm} \end{aligned}$$

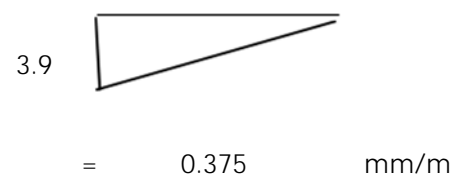


#### Potential Movement Due to wall Excavation

$$\begin{aligned} \text{Horizontal surface movement} &= 0.15\% \\ \Delta H &= 0.15\% \times 2600 = 3.9 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{Vertical Surface Movement} &= 0.10\% \\ \Delta V &= 0.10\% \times 2600 = 2.6 \text{ mm} \end{aligned}$$

$$\begin{aligned} \text{Distance behind wall to negligible movement} \\ l_h = 2600 \times 4 = 10400 \text{ mm} \end{aligned}$$



Determine Horizontal Movement

$$\text{Delta} = \frac{5.2 \text{ mm}}{10400 \text{ mm}} = 0.05\%$$

Determine Vertical Movement

$$\text{Delta} = \frac{3.9 \text{ mm}}{10400 \text{ mm}} = 0.04\%$$

Table 2.4 CIRIA C580

Category of Damage	Normal Degree	Limiting Tensile Strain %
0	Negligible	0.00% - 0.05%
1	Very slight	0.05% - 0.075%
2	Slight	0.075% - 0.15%
3	Moderate	0.15% - 0.30%
4 to 5	Severe to Very Server	> 0.30%

Anticipated Damage May be Categorised as "**Negligible to Very Slight Category 0-1**"

# Appendix C

## Method Statement

231 Goldhurst Terrace

<u>Revision</u>	<u>Date</u>	<u>Comments</u>
-	27/10/14	First Issue for Comment

## 1. Basement Formation Suggested Method Statement.

- 1.1. This method statement provides an approach which will allow the basement design to be correctly considered during construction, and the temporary support to be provided during the works. The contractor is responsible for the works on site and the final temporary works methodology and design on this site and any adjacent sites.
- 1.2. This method statement 231 Goldhurst Terrace has been written by a Chartered Engineer and in accordance with the recommendations stated in the Royal Borough of Kensington and Chelsea Town Planning policy on Subterranean Development & Camden New Basement Development Guidance Notes. The sequencing has been developed considering guidance from ASUC.
- 1.3. This method has been produced to allow for improved costings and for inclusion in the party wall Award. Should the contractor provide alternative methodology the changes shall be at their own costs, and an Addendum to the Party Wall Award will be required.
- 1.4. Contact party wall surveyors to inform them of any changes to this method statement.
- 1.5. The approach followed in this design is; to remove load from above and place loads onto supporting steelwork, then to cast cantilever retaining walls in underpin sections at the new basement level.
- 1.6. The base benefits from propping, this is provided in the final condition by the ground slab. In the temporary condition the edge of the slab is buttressed against the soil in the middle of the property, also the skin friction between the concrete base and the soil provides further resistance. The central slab is to be poured in a maximum of a 1/3 of the floor area.
- 1.7. A soil investigation has been undertaken. The soil conditions are London clays.
- 1.8. The bearing pressures have been limited to 120kN/m<sup>2</sup>. This is standard loadings for local ground conditions and acceptable to building control and their approvals.

## 2. Enabling works

- 2.1. The site is to be hoarded with ply sheet to 2.2m to prevent unauthorised public access.
- 2.2. Licenses for Skips and conveyors to be posted on hoarding

### 3. Basement Sequencing

- 3.1. Excavate Light well to front of property down to 600mm below external ground level.
- 3.2. Excavate first front corner of light well. (Follow methodology in section 4)
- 3.3. Excavate second front corner of light well. (Follow methodology in section 4)
- 3.4. Continue excavating section pins to form front light well. (Follow methodology in section 4)
- 3.5. Place cantilevered retaining wall to the left side of front opening. After 72 hours place cantilevered retaining wall to the right side of front opening.
- 3.6. Needle and prop bay/front wall. Insert support
- 3.7. Excavate out first 1.2m around front opening prop floor and erect conveyor.
- 3.8. Continue cantilevered wall formation around perimeter of basement following the numbering sequence on the drawings.
  - 3.8.1. Excavation for the next numbered sections of underpinning shall not commence until at least 8 hours after drypacking of previous works. Excavation of adjacent pin to not commence until 24 hours after drypacking. (24hours possible due to inclusion of Conbextra 100 cement accelerator to dry pack mix)
  - 3.8.2. Floor over to be propped as excavations progress. Steelwork to support Floor to be inserted as works progress.
- 3.9. Excavate a maximum of a 1/3 of the middle section of basement floor. Place reinforcement to central section of ground bearing slab and pour concrete. Excavate next third and cast slab. Excavate and cast final third and cast.
- 3.10. Provide structure to ground floor and water proofing to retaining walls as required.

### 4. Underpinning – Cantilevered Wall Creation

- 4.1. Excavate first section of retaining wall (no more than 1200mm wide). Where excavation is greater than 1.2m deep provide temporary propping to sides of excavation to prevent earth collapse (Health and Safety). A 1200mm width wall has a lower risk of collapse to the heel face.

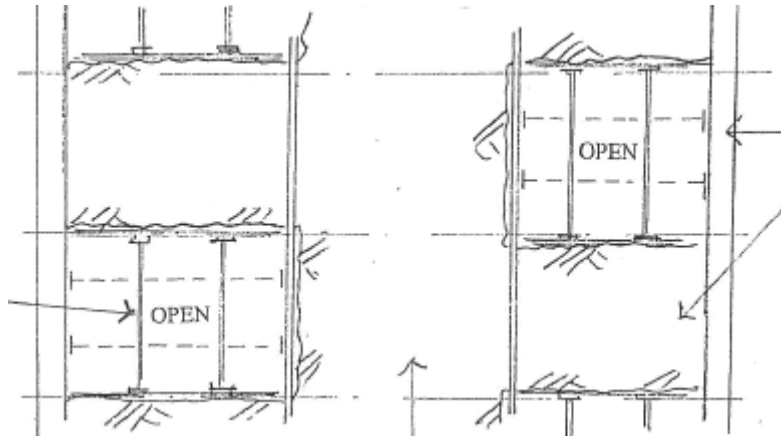
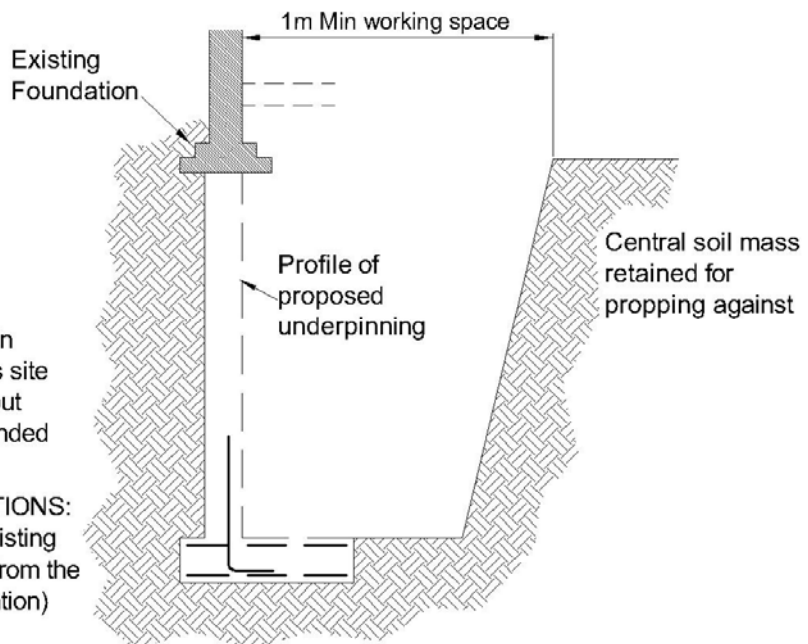


Figure 2 – Schematic Plan view of Soil Propping



Figure 3 Propping

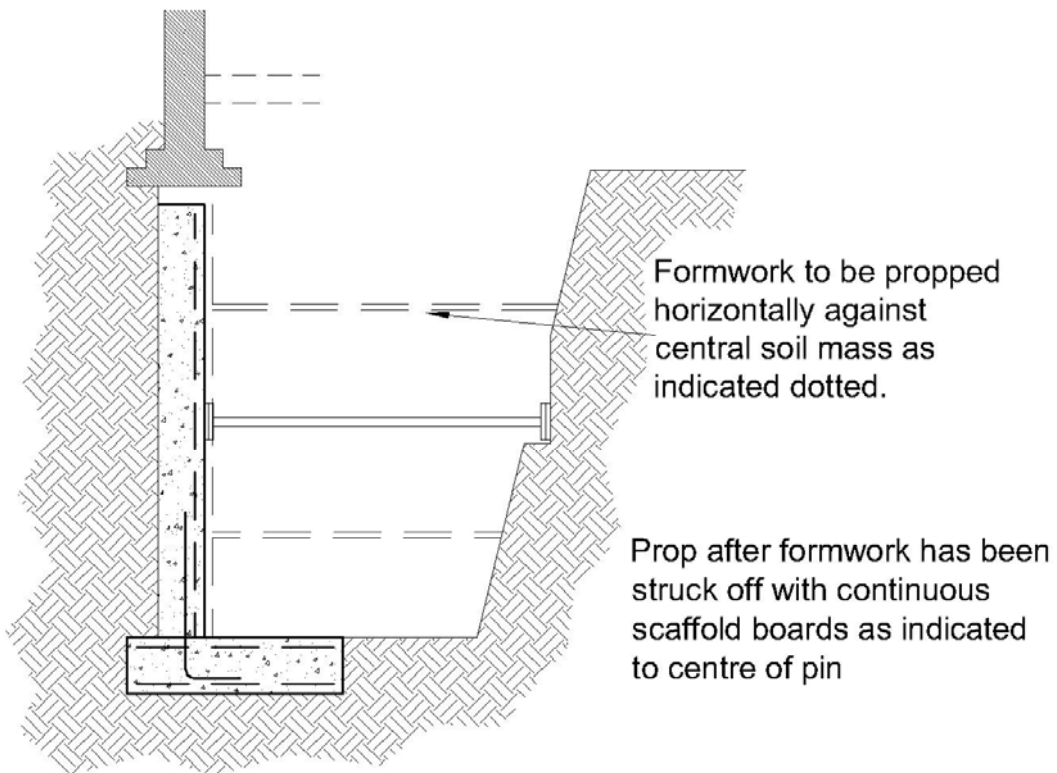
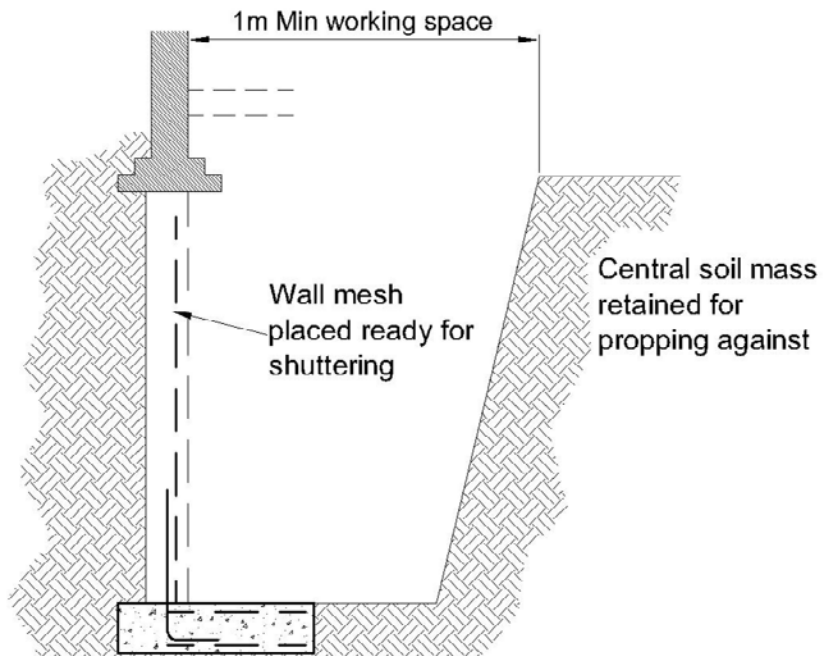


The rear of excavation may remain unsupported for max 48 hrs (or as site conditions permit) during works, but supported when the site is unattended

**NOTE RE EXISTING FOUNDATIONS:**  
 The staging of the removal of existing foundations / corbels may vary from the drawing (following site investigation)  
 Refer to method statement

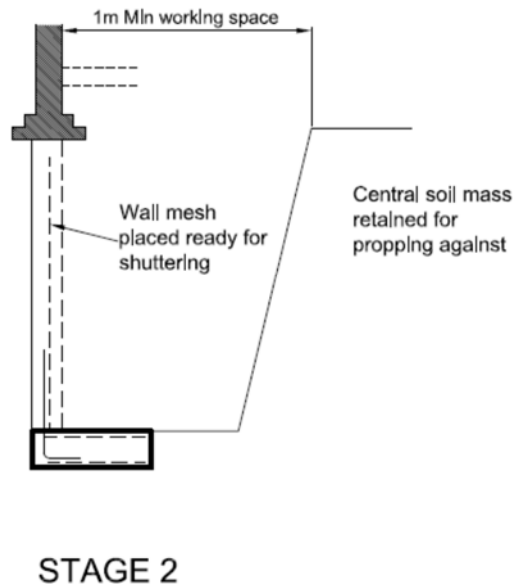
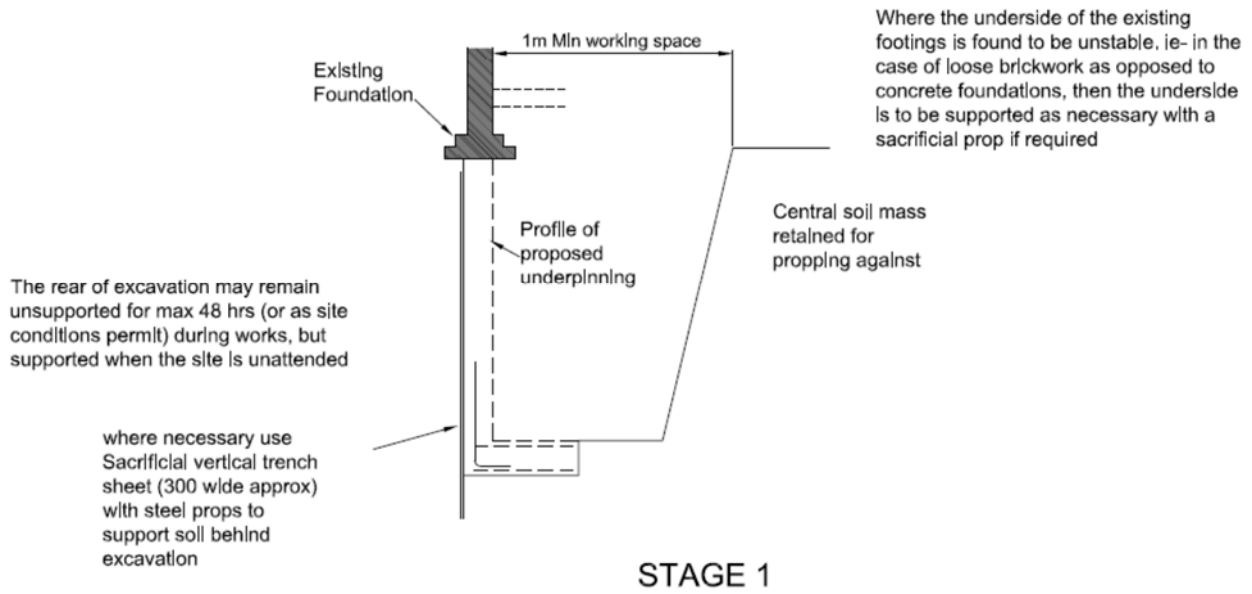


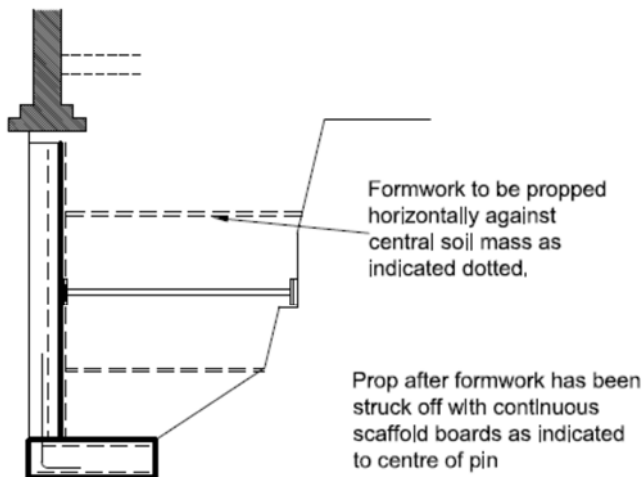
case of loose brickwork as opposed to concrete foundations, then the underside is to be supported as necessary with a sacrificial prop if required



## CLAY SOILS - STAGE 3

Granular soils:

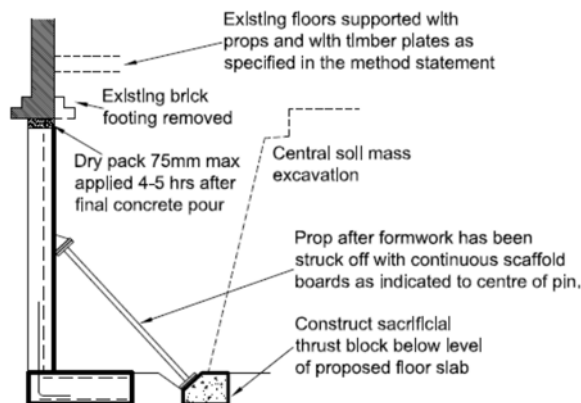




STAGE 3



Image of Stage 3 on Site



STAGE 4

- 4.1.1. Where soft spots are encountered back prop with Precast lintels or trench sheeting. Where voids are present behind the lintels (or trench sheeting) grout behind. Prior to casting place layer of DPM between PC lintels (or trench sheeting) and new concrete. The lintels are to be cut into the soil by 150mm either side of the pin. A site stock of a minimum of 10 lintels to be present for to prevent delays due to ordering. . . .
- 4.1.2. If the soil support to the ends of the lintels is insufficient then brace the ends of the PC lintels with 150x150 C24 Timbers and prop with Acrows diagonally back to the floor.
- 4.2. Visually inspect the footings and provide propping to local brickwork, if necessary props to be sacrificial and cast into the retaining wall.
- 4.3. Provide propping to floor where necessary.
- 4.4. Excavate base. Mass concrete heels to be excavated. If soil over unstable prop top with PC lintel and sacrificial prop.

- 4.5. Clear underside of existing footing.
- 4.6. Local authority inspection to be carried for approval of excavation base.
- 4.7. Place blinding.
- 4.8. Place reinforcement for retaining wall base & toe. Site supervisor to inspect and sign off works for proceeding to next stage.
- 4.9. Cast base. (on short stems it is possible to cast base and wall at same time)
- 4.10. Take 2 cubes of concrete and store for testing. Test one at 28 days if result is low test second cube. Provide results to client and design team on request or if values are below those required.
- 4.11. Horizontal temporary prop to base of wall to be inserted. Alternatively cast base against soil.
- 4.12. Place reinforcement for retaining wall stem. Site supervisor to inspect and sign off works for proceeding to next stage.
- 4.13. Drive H16 Bars UBars into soil along centre line of stem to act as shear ties to adjacent wall.
- 4.14. Place shuttering & pour concrete for retaining wall. Stop a minimum of 75mm from the underside of existing footing. Take 2 cubes of concrete and store for testing
- 4.15. Ram in drypack between retaining wall and existing masonry. (24 hours after pouring the concrete pin the gap shall be filled using a dry pack mortar.)
- 4.16. Trim back existing masonry corbel and concrete on internal face.
- 4.17. Site supervisor to inspect and sign off for proceeding to the next stage.

## 5. Approval

- 5.1. Building control officer/approved inspector to inspect pin bases and reinforcement prior to casting concrete.
- 5.2. Contractor to keep list of dates pins inspected & cast
- 5.3. One month after work completed the contractor is to contact adjacent party wall surveyor to attend site and complete final condition survey and to sign off works.

This calculation has been provided for the trench sheet and prop design of standard underpins in the temporary condition. There are gaps left between the sheeting and as such no water pressure will occur. Any water present will flow through the gaps between the sheeting and will be required to pump out.

Trench sheets should be placed at centers to deal with the ground. It is expected that the soil between the trench sheeting will arch. Looser soil will require tighter centers. It is typical for underpins to be placed at 1200c/c, in this condition the highest load on a trench sheet is when 2 nos trench sheets are used. It is for this design that these calculations have been provided.

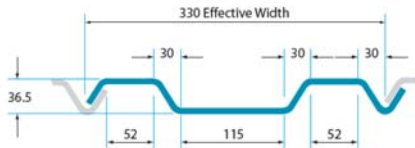
Soil and ground conditions are variable. Typically one finds that in the temporary condition clays are more stable and the  $C_u$  (cohesive) values in clay reduce the risk of collapse. It is this cohesive nature that allows clays to be cut into a vertical slope. For these calculations weak sand and gravels have been assumed. The soil properties are:

Surcharge	$sur = 10. \text{ kN/m}^2$	
Soil density	$\delta = 20 \text{ kN/m}^3$	
Angle of friction	$\phi = 25^\circ$	
Soil depth	$D_{soil} = 3000.000 \text{ mm}$	
	$k_a = (1 - \sin(\phi)) / (1 + \sin(\phi))$	<b>= 0.406</b>
	$k_p = 1 / k_a$	<b>= 2.464</b>
Soil Pressure bottom	$soil = k_a * \delta * D_{soil}$	<b>= 21.916 kN/m<sup>2</sup></b>
Surcharge pressure	$surcharge = sur * k_a$	<b>= 4.059 kN/m<sup>2</sup></b>

## Standard Lap Trench Sheeting

# STANDARD LAP

The overlapping trench sheeting profile is designed primarily for construction work and also temporary deployment.



### Technical Information

Effective width per sheet (mm)	330
Thickness (mm)	3.4
Depth (mm)	35
Weight per linear metre (kg/m)	10.8
Weight per m <sup>2</sup> (kg)	32.9
Section modulus per metre width (cm <sup>3</sup> )	48.3
Section modulus per sheet (cm <sup>3</sup> )	15.9
I value per metre width (cm <sup>4</sup> )	81.7
I value per sheet (cm <sup>4</sup> )	26.9
Total rolled metres per tonne	92.1

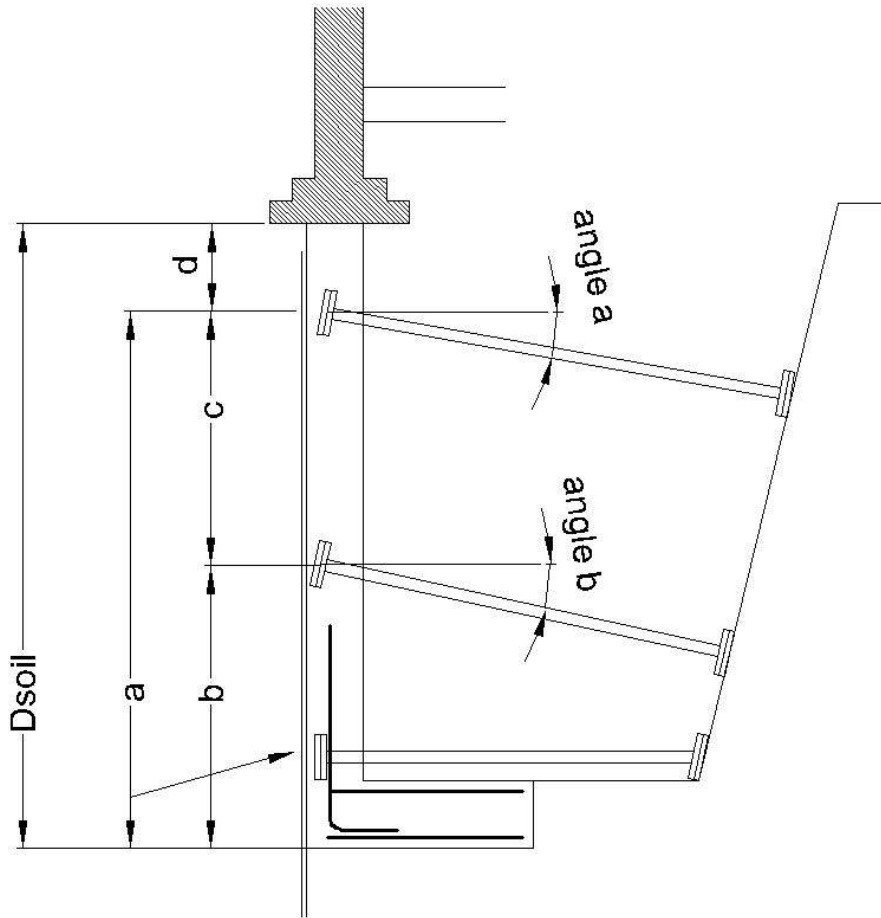


$$S_{xx} = 15.9 \text{ cm}^3$$

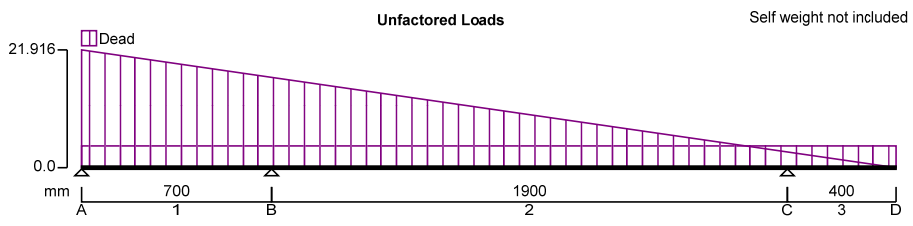
$$p_y = 275 \text{ N/mm}^2$$

$$I_{xx} = 26.9 \text{ cm}^4$$

$$A = (1 \text{ m}^2 * 32.9 \text{ kg/m}^2) / (330 \text{ mm} * 7750 \text{ kg/m}^3) = 12864.125 \text{ mm}^2$$



Length a a = 2.600 m  
 Length b bottom b = 0.700 m  
  
 Length c Middle c = a - b = 1.900m  
 Length d top d = Dsoil - a = 0.400m



**CONTINUOUS BEAM ANALYSIS - INPUT**

**BEAM DETAILS**

Number of spans = 3

**Material Properties:**

Modulus of elasticity = 205 kN/mm<sup>2</sup>

Material density = 7860 kg/m<sup>3</sup>

**Support Conditions:**

**Support A** Vertically "Restrained"  
**Support B** Vertically "Restrained"  
**Support C** Vertically "Restrained"

Rotationally "Free"  
 Rotationally "Free"  
 Rotationally "Free"



**Support D** Vertically **"Free"**

Rotationally **"Free"**

**Span Definitions:**

<b>Span 1</b>	Length = <b>700</b> mm	Cross-sectional area = <b>12864</b> mm <sup>2</sup>	Moment of inertia = <b>269.×10<sup>3</sup></b> mm <sup>4</sup>
<b>Span 2</b>	Length = <b>1900</b> mm	Cross-sectional area = <b>12864</b> mm <sup>2</sup>	Moment of inertia = <b>269.×10<sup>3</sup></b> mm <sup>4</sup>
<b>Span 3</b>	Length = <b>400</b> mm	Cross-sectional area = <b>12864</b> mm <sup>2</sup>	Moment of inertia = <b>269.×10<sup>3</sup></b> mm <sup>4</sup>

**LOADING DETAILS**

**Beam Loads:**

- Load 1** UDL Dead load **4.1** kN/m
- Load 2** VDL Dead load **21.9** kN/m to **0.0** kN/m

**LOAD COMBINATIONS**

**Load combination 1**

- Span 1** 1×Dead
- Span 2** 1×Dead
- Span 3** 1×Dead

**CONTINUOUS BEAM ANALYSIS - RESULTS**

**Unfactored support reactions**

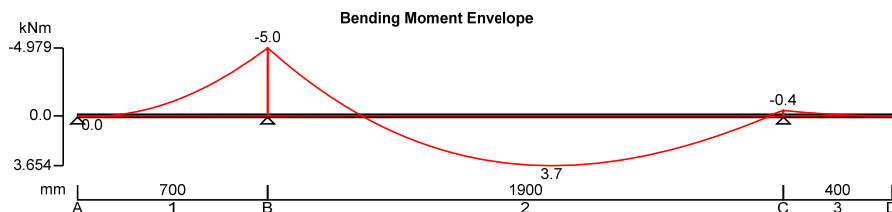
	<b>Dead (kN)</b>							
<b>Support A</b>	<b>-1.4</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Support B</b>	<b>-32.8</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Support C</b>	<b>-10.8</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
<b>Support D</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

**Support Reactions - Combination Summary**

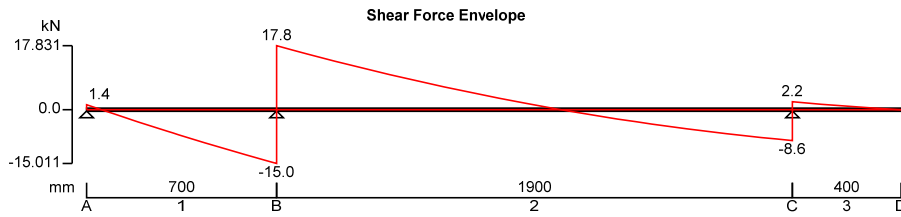
<b>Support A</b>	Max react = <b>-1.4</b> kN	Min react = <b>-1.4</b> kN	Max mom = <b>0.0</b> kNm	Min mom = <b>0.0</b> kNm
<b>Support B</b>	Max react = <b>-32.8</b> kN	Min react = <b>-32.8</b> kN	Max mom = <b>0.0</b> kNm	Min mom = <b>0.0</b> kNm
<b>Support C</b>	Max react = <b>-10.8</b> kN	Min react = <b>-10.8</b> kN	Max mom = <b>0.0</b> kNm	Min mom = <b>0.0</b> kNm
<b>Support D</b>	Max react = <b>0.0</b> kN	Min react = <b>0.0</b> kN	Max mom = <b>0.0</b> kNm	Min mom = <b>0.0</b> kNm

**Beam Max/Min results - Combination Summary**

Maximum shear = <b>17.8</b> kN	Minimum shear $F_{min}$ = <b>-15.0</b> kN
Maximum moment = <b>3.7</b> kNm	Minimum moment = <b>-5.0</b> kNm
Maximum deflection = <b>21.0</b> mm	Minimum deflection = <b>-14.3</b> mm







Number of sheets Nos = 2

$$\text{Mallowable} = S_{xx} * p_y * \text{Nos} = 8.745 \text{ kNm}$$

Safe working loads for Acrow Props — loads given in kN

SRU 4.0

For normal purposes 1 kilo Newton (kN) = 100 kg		Height	m	2.0	2.25	2.5	2.75	3.0	3.25	3.5	3.75	4.0	4.25	4.5	4.75
			ft	6.6	7.4	8.2	9.0	9.8	10.7	11.5	12.3	13.1	13.9	14.8	15.6
<b>TABLE A</b> Props loaded concentrically and erected vertically	Prop size 1 or 2			35	35	35	34	27	23						
	Prop size 3						34	27	23	21	19	17			
	Prop size 4								32	25	21	18	16	14	12
<b>TABLE B</b> Props loaded concentrically and erected 1½° max. out of vertical	Prop size 1 or 2 or 3			35	32	26	23	19	17	15	13	12			
	Prop size 4								24	19	15	12	11	10	9
<b>TABLE C</b> Props loaded 25 mm eccentricity and erected 1½° max. out of vertical	Prop size 1 or 2 or 3			17	17	17	17	15	13	11	10	9			
	Prop size 4								17	14	11	10	9	8	7
<b>TABLE D</b> Props loaded concentrically and erected 1½° out of vertical and laced with scaffold tubes and fittings	Prop size 3						35	33	32	28	24	20			
	Prop size 4								35	35	35	35	27	25	21

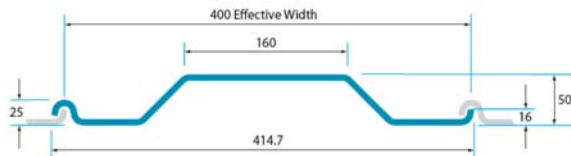
$$\text{Shear } V = (14.6 \text{ kN} + 13.4 \text{ kN}) / 2 = 14.000 \text{ kN}$$

Any Acro Prop is acceptable

## KD4 sheets

# KD4

The overlapping trench sheeting profile is a heavier version of the Standard Lap, with a wider gauge and width coverage, designed in large for construction work.



### Technical Information

Effective width per sheet (mm)	400
Thickness (mm)	6.0
Depth (mm)	50
Weight per linear metre (kg/m)	21.90
Weight per m <sup>2</sup> (kg)	55.2
Section modulus per metre width (cm <sup>3</sup> )	101
Section modulus per sheet (cm <sup>3</sup> )	40.34
I value per metre width (cm <sup>4</sup> )	250
I value per sheet (cm <sup>4</sup> )	101
Total rolled metres per tonne	45.659

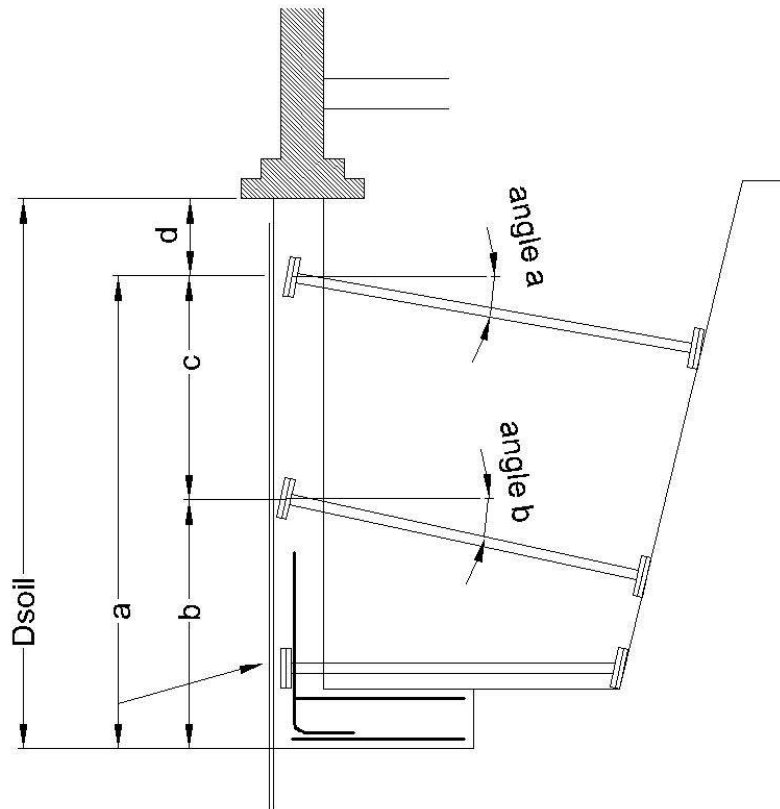


$$S_{xx} = 48.3\text{cm}^3$$

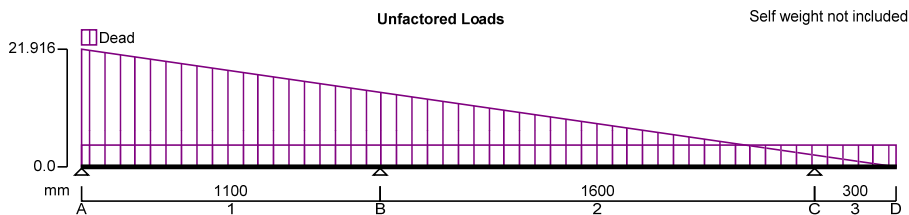
$$p_y = 275\text{N/mm}^2$$

$$I_{xx} = 26.9\text{cm}^4$$

$$A = (1\text{m}^2 * 55.2\text{kg/m}^2) / (400\text{mm} * 7750\text{kg/m}^3) = 17806.452\text{mm}^2$$



Length a a = 2.700 m  
 Length b bottom b = 1.100 m  
  
 Length c Middle c = a - b = 1.600m  
 Length d top d = Dsoil - a = 0.300m



**CONTINUOUS BEAM ANALYSIS - INPUT**

**BEAM DETAILS**

Number of spans = 3

**Material Properties:**

Modulus of elasticity = 205 kN/mm<sup>2</sup>

Material density = 7860 kg/m<sup>3</sup>

**Support Conditions:**

**Support A** Vertically "Restrained"

Rotationally "Free"

**Support B** Vertically "Restrained"

Rotationally "Free"

**Support C** Vertically "Restrained"

Rotationally "Free"

**Support D** Vertically "Free"

Rotationally "Free"

**Span Definitions:**

**Span 1** Length = 1100 mm

Cross-sectional area = 17806 mm<sup>2</sup>

Moment of inertia = 269.×10<sup>3</sup> mm<sup>4</sup>

**Span 2** Length = 1600 mm

Cross-sectional area = 17806 mm<sup>2</sup>

Moment of inertia = 269.×10<sup>3</sup> mm<sup>4</sup>

**Span 3** Length = **300 mm** Cross-sectional area = **17806 mm<sup>2</sup>** Moment of inertia = **269.x10<sup>3</sup> mm<sup>4</sup>**

**LOADING DETAILS**

**Beam Loads:**

- Load 1** VDL Dead load **21.9 kN/m to 0.0 kN/m**
- Load 2** UDL Dead load **4.1 kN/m**

**LOAD COMBINATIONS**

**Load combination 1**

- Span 1** 1xDead
- Span 2** 1xDead
- Span 3** 1xDead

**CONTINUOUS BEAM ANALYSIS - RESULTS**

**Support Reactions - Combination Summary**

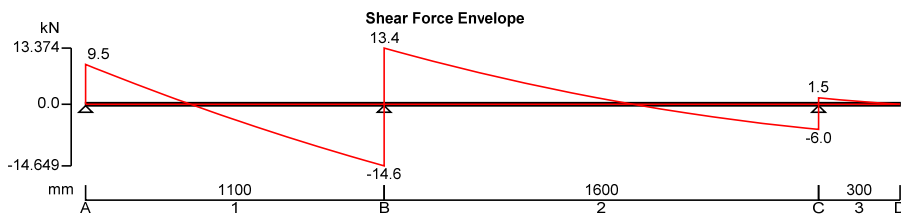
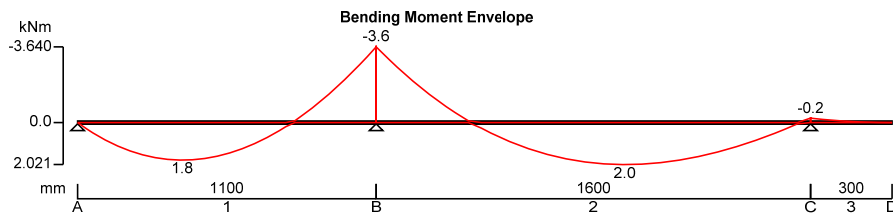
<b>Support A</b>	Max react = <b>-9.5 kN</b>	Min react = <b>-9.5 kN</b>	Max mom = <b>0.0 kNm</b>	Min mom = <b>0.0 kNm</b>
<b>Support B</b>	Max react = <b>-28.0 kN</b>	Min react = <b>-28.0 kN</b>	Max mom = <b>0.0 kNm</b>	Min mom = <b>0.0 kNm</b>
<b>Support C</b>	Max react = <b>-7.5 kN</b>	Min react = <b>-7.5 kN</b>	Max mom = <b>0.0 kNm</b>	Min mom = <b>0.0 kNm</b>
<b>Support D</b>	Max react = <b>0.0 kN</b>	Min react = <b>0.0 kN</b>	Max mom = <b>0.0 kNm</b>	Min mom = <b>0.0 kNm</b>

**Beam Max/Min results - Combination Summary**

Maximum shear = **13.4 kN** Minimum shear  $F_{min}$  = **-14.6 kN**

Maximum moment = **2.0 kNm** Minimum moment = **-3.6 kNm**

Maximum deflection = **7.7 mm** Minimum deflection = **-4.9 mm**



Number of sheets Nos = 2

Mallowable =  $S_{xx} * p_y * Nos = 26.565kNm$

SRU 4-0

Safe working loads for Acrow Props — loads given in kN

For normal purposes 1 kilo Newton (kN) = 100 kg	Height														
		m	2.0	2.25	2.5	2.75	3.0	3.25	3.5	3.75	4.0	4.25	4.5	4.75	
	ft	6.6	7.4	8.2	9.0	9.8	10.7	11.5	12.3	13.1	13.9	14.8	15.6		
<b>TABLE A</b> Props loaded concentrically and erected vertically	Prop size 1 or 2	35	35	35	34	27	23								
	Prop size 3				34	27	23	21	19	17					
	Prop size 4						32	25	21	18	16	14	12		
<b>TABLE B</b> Props loaded concentrically and erected 1½° max. out of vertical	Prop size 1 or 2 or 3	35	32	26	23	19	17	15	13	12					
	Prop size 4						24	19	15	12	11	10	9		
<b>TABLE C</b> Props loaded 25 mm eccentricity and erected 1½° max. out of vertical	Prop size 1 or 2 or 3	17	17	17	17	15	13	11	10	9					
	Prop size 4						17	14	11	10	9	8	7		
<b>TABLE D</b> Props loaded concentrically and erected 1½° out of vertical and laced with scaffold tubes and fittings	Prop size 3				35	33	32	28	24	20					
	Prop size 4						35	35	35	35	27	25	21		

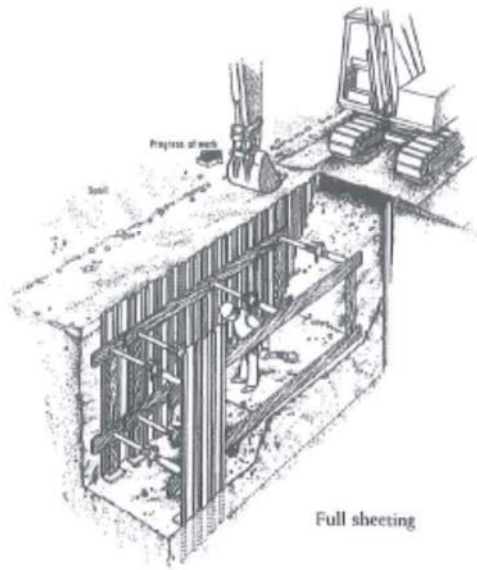
Shear V = (14.6kN + 13.4kN) / 2 = 14.000kN

Any Acro Prop is acceptable

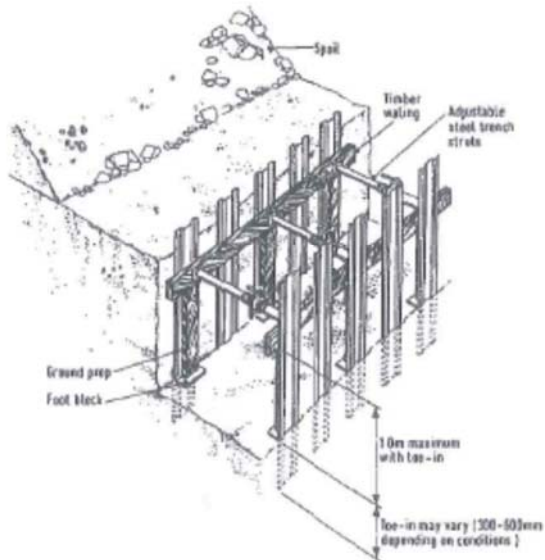
## Sheeting requirements

Ground Type	Trench Depth, D			
	Less than 1.2m <sup>(1)</sup>	1.2 to 3m	3 to 4.5m	4.5 to 6m
Sands and gravels	<del>Close, ½, ¼, ⅛ or nil</del>	Close	Close	Close
Silt				
Soft Clay				
High compressibility Peat				
Firm/stiff Clay	<del>½, ¼ or nil</del>	½ or ¼	½ or ¼	Close or ½
Low compressibility Peat				
Rock <sup>(2)</sup>	<del>From ½ for incompetent rock to nil for competent rock<sup>(3)</sup></del>			

# Sheeting requirements



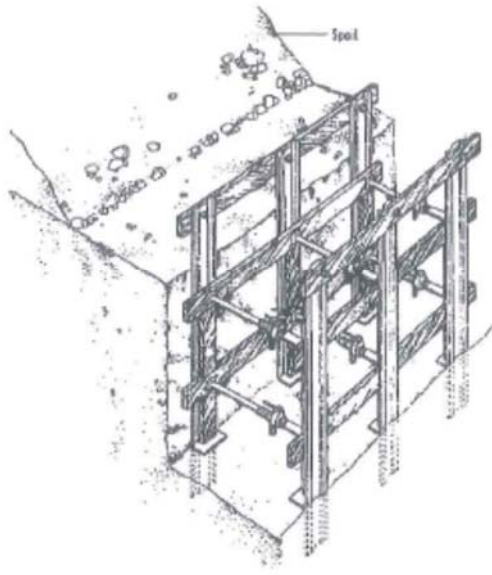
# Sheeting requirements



Half sheeting  
shown for 1.5 m deep trench

11/04/2014


# Sheeting requirements



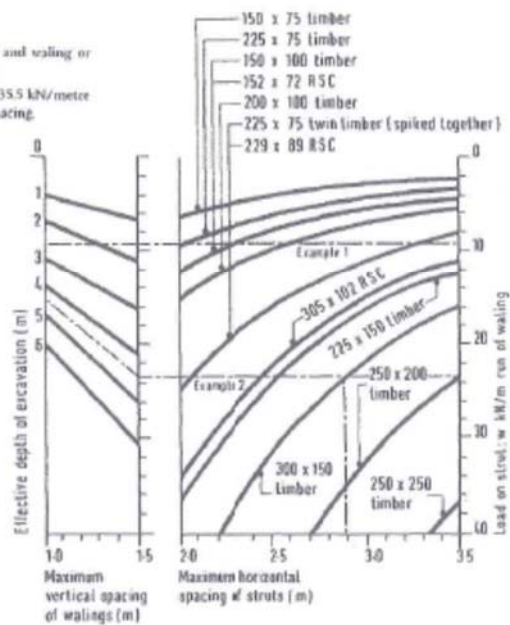
11/04/14 Quarter sheeting

## Design to CIRIA 97

Note:  
 For standard Speedshore hydraulic strut and waling or equivalent use the curve for 229 x 89 RSC.  
 Heavy duty Speedshores have a capacity of 35.5 kN/metre run of waling at 3.2m horizontal strut spacing.


 Any proprietary system should be checked against manufacturer's latest information.

Use for:  
 Granular soils  
 Mixed soils  
 Short term trenches in clay  
 (see notes opposite)

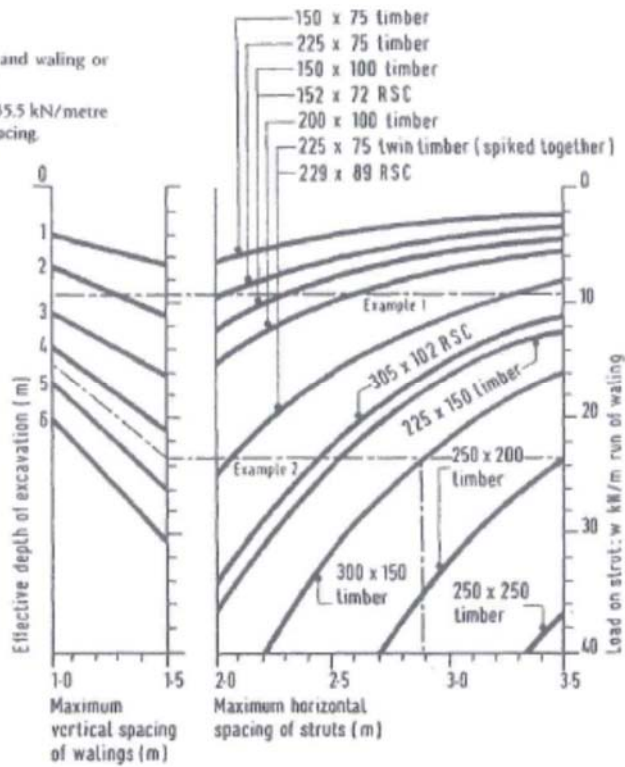




**Note:**  
 For standard Speedshore hydraulic strut and waling or equivalent use the curve for 229 x 89 RSC.  
 Heavy duty Speedshores have a capacity of 35.5 kN/metre run of waling at 3.2m horizontal strut spacing.

 Any proprietary system should be checked against manufacturer's latest information.

Use for:  
 Granular soils  
 Mixed soils  
 Short term trenches in clay  
 (see notes opposite)







**To:** Liz Brown/CRH@Campbellreith, Thushy Shanmugarajah/CRH@Campbellreith, Adam Fisher/CRH@Campbellreith, Andrew Marlow/CRH@CampbellReith, Stephen Ash/CRH@Campbellreith, Robert Morley/CRH@Campbellreith, Tom  
**Cc:**  
**Bcc:**  
**Subject:** 12066 - Croft Structural Engineers BIA Audit Query Tracker Response  
**From:** Sam Knight/CRH - Wednesday 16/09/2015 16:00  
This message will be sent with a digital signature.

----- Forwarded by Sam Knight/CRH on 16/09/2015 15:54 -----

**From:** "Pawel Rogalewicz" <pawel@croftse.co.uk>  
**To:** <SamKnight@campbellreith.com>  
**Cc:** "Sarah Murray-Smith" <msarchitects@btconnect.com>, <fabennett@ashton-bennett.co.uk>, "Ray Reilly" <info@rprplanning.co.uk>, "Susan Zur-Szpiro" <susanzs231@gmail.com>  
**Date:** 16/09/2015 15:37  
**Subject:** 231 Goldhurst Terrace

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Dear Mr. Knight,

It was good to speak with you over the phone and discuss your comments.

I understand the value of the bearing pressure within the calculations was one of the queries. The value of 120kPa was taken from the point 13.7 Foundation Design of the Ashton Bennett's Basement Impact Assessment. Please find below the answers to your queries;

Please see answers to your queries below;

- The figure at the start of the GMA appears to show the property being underpinned as opposed to the neighbouring property being assessed for movement. It is not clear which building /part of building is being assessed.

The figure is an indicative representation of the property; however the diagrams below represent movement at distance up to 10.4m from the property, therefore includes the potential movement of the neighbouring property.

- The estimate of movement for installation seems adequate, however, the assessment for movements due to excavation assume a high stiffness support, confirmation is required that this is appropriate for a cantilevered wall.

The RC retaining walls are designed to be inherently stable during the construction phase without temporary propping to the head, however the soil is being propped along the length of the wall during the phase, hence the use of a high stiffness support parameter. Please see Basement Method Statement Points 3 Basement sequencing and 4 Underpinning – Cantilevered Wall Creation. Figures 1 & 2 show the Soil propping.

- The plotted ground movement does not appear to agree with the figures predicted.

We altered slightly the calculation to avoid confusion, although final result remain unchanged.

- It is not clear where vertical ground movements have been considered.

See Ground movement calculations.

· The BSMS states damage will be 'Negligible to Slight Category 0'. This is confusing - Negligible is Category 0 (hairline crack) and Slight is Category 2 (cracks up to 5mm).

The calculation values are correct, although there was a minor miss within the conclusion. The Final conclusion should be "Negligible to Very Slight". This was amended within the report.

kind regards,

**Pawel Rogalewicz**

Senior Structural Engineer  
MSc BEng



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